DEVELOPING A STATE WATER PLAN

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1976

by

C. T. Sumsion and others

United States Geological Survey

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Most numbers are given in this report in English units followed by metric units in parentheses. The conversion factors used are shown to four significant figures. However, in the text the metric equivalents are shown only to the number of significant figures consistent with the accuracy of the number in English units.

English Units (Multiply)	English Abbreviation	(by)	Metric Units (To obtain)	Metric Abbreviation
Acre-feet	acre-ft	0.001233	Cubic hectometres	hm^3
Feet	ft	.3048	Metres	m
Inches	in	25.40	Millimetres	mm
Miles	mi	1.609	Kilometres	km
Square miles	mi^2	2.590	Square kilometres	km^2

Chemical concentration is given only in metric units--milligrams per litre (mg/l). For concentrations less than 7,000 mg/l, the numerical value is about the same as for concentrations in the English unit, parts per million.

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INTRODUCTION

This report is the thirteenth in a series of annual reports that describe ground-water conditions in Utah. Reports in the series, prepared cooperatively by the U.S. Geological Survey and the Utah Division of Water Resources, are designed to provide data to enable interested parties to keep abreast of changing ground-water conditions.

This report, like the others (see references, p. 18), contains information on well construction, ground-water withdrawals, water-level changes, and related changes in precipitation and streamflow. Supplementary data such as graphs showing chemical quality of water and maps showing water-table configuration are included in reports of this series only for those years or areas for which applicable data are available and are important to a discussion of changing ground-water conditions.

The report includes individual discussions of selected major areas of ground-water withdrawal in the State for the calendar year 1975. Water-level fluctuations, however, are described for the period spring 1975 to spring 1976. Much of the data used in the report were collected by the Geological Survey in cooperation with the Division of Water Rights, Utah Department of Natural Resources.

The following reports dealing with ground water in the State were released by the Geological Survey during 1975:

Availability of ground water for irrigation, municipal, or industrial use in the Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah, by W. H. McGavock and R. J. Edmonds, U.S. Geological Survey Miscellaneous Investigations Map I-878.

Hydrologic reconnaissance of the Montezuma Creek-Aneth area, southeastern Utah, by C. T. Sumsion, U.S. Geological Survey Open-File Report 75-268.

Hydrologic reconnaissance of the Pine Valley drainage basin, Millard, Beaver, and Iron Counties, Utah, by J. C. Stephens, Utah Department of Natural Resources Technical Publication 51 (in press).

Ground-water conditions in Utah, spring of 1975, by J. H. Eychaner and others, Utah Division of Water Resources Cooperative Investigations Report 14.

Ground-water inflow to Great Salt Lake, Utah [abs.], by Ted Arnow and J. C. Stephens, Geological Society of America Abstracts with Programs, 1975 Annual Meetings, October 20-22, 1975, Salt Lake City, p. 981.

Fracturing and subsidence of the land surface caused by the withdrawal of ground water in the Milford area, Utah [abs.], by R. M. Cordova and R. W. Mower, Geological Society of America Abstracts with Programs, 1975 Annual Meetings, October 20-22, 1975, Salt Lake City, p. 1039.

Largest known landslide of its type in the United States--A failure by lateral spreading in Davis County, Utah, by Richard Van Horn, Utah Geological and Mineral Survey Utah Geology, v. 2, no. 1, p. 83-88.

Reconnaissance investigations of ground water in the Great Salt Lake Desert drainage basin, Utah and Nevada [abs.], by J. C. Stephens, Geological Society of America Abstracts with Programs, 1975 Annual Meetings, October 20-22, 1975, Salt Lake City, p. 1282.

Seepage study of the Rocky Point Canal and the Grey Mountain-Pleasant Valley Canal systems, Duchesne County, Utah, by R. W. Cruff and J. W. Hood, Utah Department of Natural Resources Technical Publication 50 (in press).

UTAH'S GROUND-WATER RESERVOIRS

Small quantities of ground water can be obtained from wells throughout much of Utah, but large supplies that are of suitable chemical quality for irrigation, public supply, or industrial use, generally can be obtained only in specific areas. The major areas of ground-water development that are discussed in this report are shown in figure 1 and named in table 1. Only a few wells outside of these areas yield large supplies of water of good chemical quality.

About 2 percent of the wells in Utah obtain water from consolidated rocks. The consolidated rocks that yield the most water are lava flows, such as basalt, which contain interconnected vesicular openings or fractures; limestone, which contains fractures or other openings enlarged by solution; and sandstone, which contains interconnected openings between the grains that form the rock and may also contain open fractures. Most of the wells that tap consolidated rocks are in the eastern and southern parts of the State, in areas where water supplies cannot be obtained readily from unconsolidated rocks.

About 98 percent of the wells in Utah draw water from unconsolidated rocks. These rocks may consist of boulders, gravel, sand, silt, or clay, or a mixture of some or all of these sizes. Wells obtain the largest yields from the coarser materials that are sorted into deposits of uniform grain size. Most wells that tap unconsolidated rocks are in large intermountain basins, which have been partly filled with debris from the adjacent mountains.

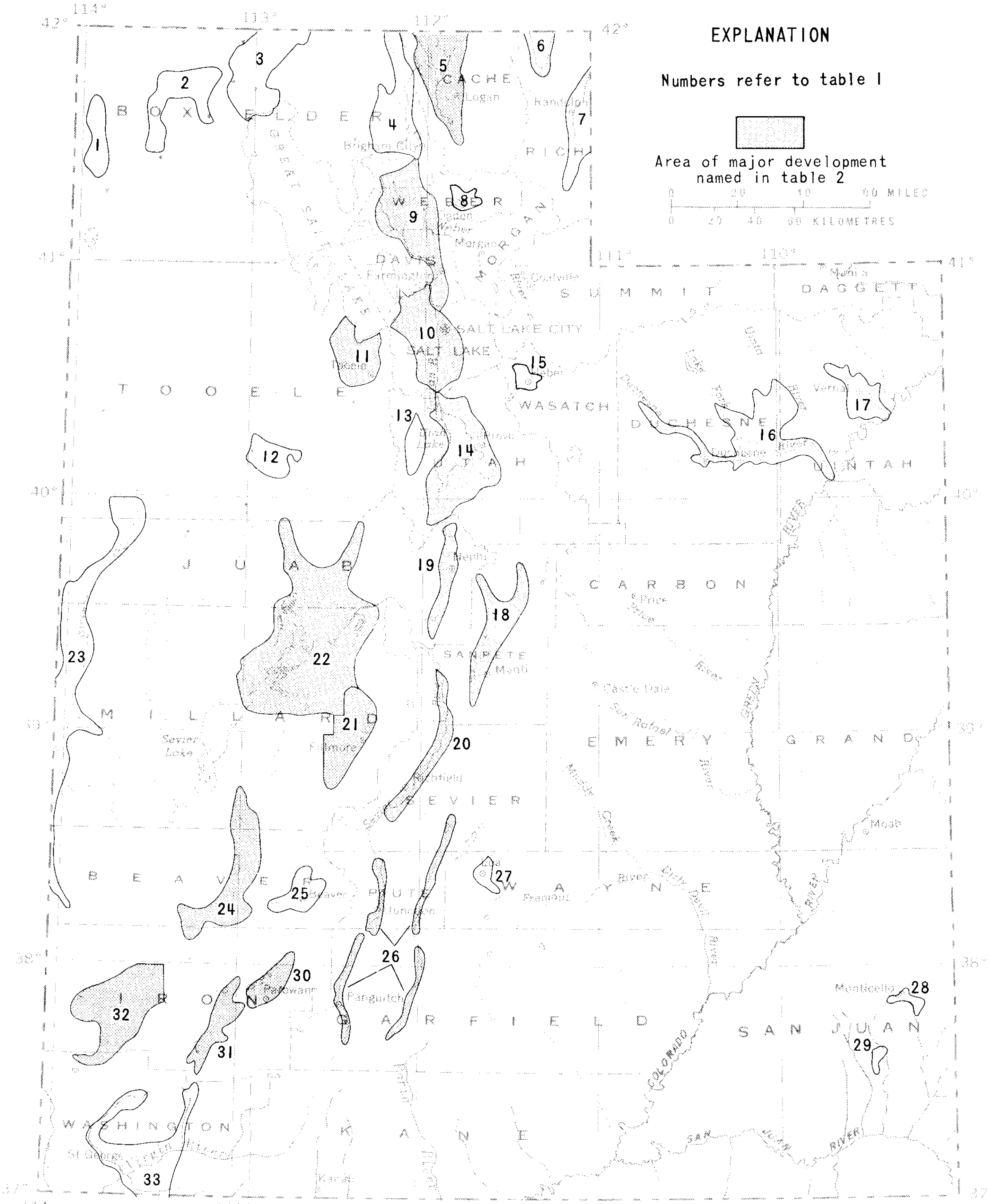

Figure 1.—Areas of ground-water development specifically referred to in this report.

Table 1.--Areas of ground-water development specifically referred to in this report

(Locations are shown in fig. 1)

	Area	Principal type of water-bearing rocks
1.	Grouse Creek valley	Unconsolidated
2.	Park Valley	Do.
3.	Curlew Valley	Unconsolidated and consolidated
4.	Malad-lower Bear River valley	Unconsolidated
5.	Cache Valley	Do.
6.	Bear Lake valley	Do.
7.	Upper Bear River valley	Do.
8.	Ogden Valley	Do.
9.	East Shore area	Do.
10.	Jordan Valley	Do.
11.	Tooele Valley	Do.
12.	Dugway area	Do.
13.	Cedar Valley	Do.
14.	Utah and Goshen Valleys	Do.
15.	Heber Valley	Do.
16.	Duchesne River area	Unconsolidated and consolidated
17.	Vernal area	Do.
18.	Sanpete Valley	Unconsolidated
19.	Juab Valley	Do.
20.	Central Sevier Valley	Do.
21.	Pavant Valley	Do.
22.	Sevier Desert	Do.
23.	Snake Valley	Do.
24.	Milford area	Do.
25.	Beaver Valley	Do.
26.	Upper Sevier Valleys	Do.
27.	Upper Fremont Valley	Unconsolidated and consolidated
28.	Monticello area	Unconsolidated
29.	Blanding area	Do.
30.	Parowan Valley	Unconsolidated and consolidated
31.	Cedar City Valley	Unconsolidated
32.	Beryl-Enterprise area	Do.
33.	Central Virgin River area	Unconsolidated and consolidated

SUMMARY OF CONDITIONS

The estimated total withdrawal of water from wells in Utah in 1975 was about 800,000 acre-ft (986 hm^3), which is about 80,000 acre-ft (99 hm^3) less than in 1974, but 90,000 acre-ft (111 hm^3) greater than the average annual withdrawal during 1965-74 (table 2). Both the decrease from 1974 and the increase over the 10-year average were due primarily to changes in withdrawals for irrigation.

Total withdrawal for irrigation in 1975 was about 550,000 acre-ft (678 hm^3), which is about 61,000 acre-ft (75 hm^3) less than in 1974 and about 50,000 acre-ft (62 hm^3) more than the 1965-74 average calculated from prior reports in this series. (See references, p. 18) Irrigation withdrawals in most major areas of ground-water development were less in 1975 than in 1974. Slight increases in irrigation withdrawals were reported only in Cache Valley and the Sevier Desert. Irrigation withdrawals in Jordan Valley and the upper and central Sevier Valleys were unchanged.

The quantities of water withdrawn from wells for irrigation are closely related to local climatic conditions. Precipitation in 1975 was above normal in most of Utah; only the south-central and extreme southwestern parts of the State received below normal precipitation (National Oceanic and Atmospheric Administration, 1975). Most areas had near- or above-average snow cover, and reservoir storage was more than 120 percent of the 1958-72 average on March 1, 1975 (U.S. Dept. Agriculture, 1975).

Changes in ground-water levels in Utah from the spring of 1975 to the spring of 1976 reflected the generally increased availability of surface water and the decrease in ground-water withdrawals. Water levels generally rose in most major ground-water basins in the northern and central parts of the State, but declined in some of the south-central and southwestern ground-water basins.

The larger ground-water basins and those containing most of the ground-water development in Utah are shown in figure 1. Table 2 gives information about the number of wells constructed, withdrawals of water from wells for principal uses, and total withdrawals in 1975 for selected major ground-water basins. For comparison, total withdrawals in 1974 and average annual withdrawals during the 10-year period 1965-74 are also shown. The discussions that follow summarize the ground-water conditions in areas of major ground-water development.

Table 2.--Well construction and withdrawal of water from wells in Utah

Area	Number in figure 1	Number of wells completed in 1975[1]			Estimated withdrawal from wells (acre-ft)						
		Diameter			1975						
		Less than 6 inches	6 inches or more[2]	Large-withdrawal wells	Irrigation	Industry	Public supply	Domestic and stock	Total (rounded)	1974 Total[3,4]	1965-74 Average annual[4]
Cache Valley	5	7	0	0	10,700	8,700[5]	3,300	2,100	25,000	24,000	25,000
East Shore area	9	18	2	0	17,300[6]	6,300	17,600	-	41,000	50,000	47,000
Jordan Valley	10	65	1	3	4,600	43,400[7]	43,300	33,500[5]	125,000	130,000	115,000
Tooele Valley	11	13	2	1	25,200[6]	1,000	2,500	200	29,000	33,000	25,000
Utah and Goshen Valleys	14	65	6	3	54,500	13,800	16,500	12,700[8]	98,000	106,000	86,000
Juab Valley	19	1	1	0	24,900	50	0	200	25,000	31,000	21,000
Sevier Desert	22	8	2	2	22,700	600	1,500	1,100	26,000	25,000	26,000
Sanpete Valley	18	1	0	0	10,800	500	900	3,000[8]	15,000	17,000	16,000
Upper and central Sevier Valleys	26,20	12	0	1	12,000	100	1,700	6,200	20,000	20,000	19,000
Pavant Valley	21	1	2	6	97,300	100	400	300	98,000	101,000	79,000
Cedar City Valley	31	4	4	6	25,200[9]	1,000	1,900	200	28,000	42,000	29,000
Parowan Valley	30	3	0	0	27,900[9,10]	0	150	150	28,000	31,000	23,000
Escalante Valley Milford area	24	1	0	6	58,800[9]	300	800	100	60,000	70,000	54,000
Beryl-Enterprise area	32	3	1	3	84,500[9]	0	100	600	85,000	93,000	77,000
Beaver Valley	25	2	5	3	6,500	100	900	100	8,000	10,000	6,000
Other areas[11]		169	50	45	62,800	1,200	16,000	500	81,000	96,000	58,000
Totals (rounded)		373	76	79	550,000	77,000	110,000	61,000	800,000	880,000	710,000

1 Compiled from data supplied by Utah Department of Natural Resources, Division of Water Rights. Includes deepened and replacement wells.
2 Wells (6 inches or more in diameter) constructed for irrigation, industry, or public supply. Included under "6 inches or more."
3 From Eychaner and others (1975, p. 6) with minor revisions.
4 Calculated from previous reports of this series. Some figures include unpublished revisions.
5 Includes some use for fish and fur culture.
6 Includes some domestic and stock use.
7 Includes some use for air conditioning.
8 Includes some use for irrigation.
9 Data from local water commissioners.
10 Includes some use for stock.
11 Withdrawals are estimated minimum amount.

MAJOR AREAS OF GROUND-WATER DEVELOPMENT

CACHE VALLEY

by W. N. Jibson

Total discharge from pumped and flowing wells in Cache Valley in 1975 was about 25,000 acre-ft (31 hm^3) compared to 24,000 acre-ft (30 hm^3) reported for 1974 and was the same as the average annual for 1965-74 (table 2). The apparent increase over last year was due primarily to a revision of procedures for estimating discharge from unmeasured flowing wells. Withdrawals for industry and for public supply increased slightly over 1974, though per-capita use in municipalities generally was less than in 1974.

Changes in ground-water levels of less than 2 ft (0.6 m) occurred from March 1975 to March 1976 (fig. 2). The area around Logan continued, as in the previous year (Eychaner and others, 1975, fig. 2), to show a small rise. Water levels also rose slightly in the Richmond area, where up to 3.5 ft (1.1 m) decline had been measured in the previous year.

The long-term trend in the water level in well (A-12-1)29cab-1, the annual discharge of the Logan River near Logan, and the cumulative departure from the average annual precipitation at Logan Utah State University are shown for comparison in figure 3. Precipitation during June, August, and September 1975 was below average; but the annual total was 19.89 in (505 mm), which was 2.11 in (54 mm) above the 1941-73 average. Discharge of the Logan River during the year was 222,900 acre-ft (275 hm^3), about 6,800 acre-ft (8.4 hm^3) less than in 1974, but 43,500 acre-ft (53.6 hm^3) more than the 1941-73 average. A slight increase in withdrawal of ground water for irrigation, about 200 acre-ft (0.25 hm^3) over the previous year, was probably a result of below-average soil moisture in March (U.S. Dept. Agriculture, 1975) and below-average precipitation during much of the irrigation season. The water-level rise in the well near Logan (fig. 3) and in much of Cache Valley was a result of above-average availability of surface water, which provided greater than average recharge.

EAST SHORE AREA

by E. L. Bolke

The withdrawal from wells in the East Shore area in 1975 was about 41,000 acre-ft (51 hm^3), 9,000 acre-ft (11 hm^3) less than that reported for 1974 and 6,000 acre-ft (7.4 hm^3) less than the 1965-74 average (table 2). The decrease was due chiefly to decreased withdrawal from wells used for public supply.

From March 1975 to March 1976, water levels rose in most of the East Shore area (fig. 4). The rises were due to decreased withdrawals from wells and to above-average precipitation during 1975. The largest rises were in small areas south of Willard and southeast of North Ogden. Water levels near the Bountiful area showed a decline, probably because they have not completely recovered from withdrawals during previous years.

The long-term relation between water levels in selected wells and precipitation at Ogden Pioneer powerhouse is shown in figure 5. Water levels in three of four observation wells have generally remained unchanged during the previous 10 years despite above-normal precipitation. The water level in the fourth well shows a general increase during the previous 10 years due to increased precipitation and due to importation of water from the Weber River.

JORDAN VALLEY

by R. W. Mower

The withdrawal of water from wells in Jordan Valley in 1975 was 125,000 acre-ft (154 hm^3), a decrease of 5,000 acre-ft (6.2 hm^3)--about 4 percent--from 1974 but an increase of 10,000 acre-ft (12 hm^3)--about 9 percent--above the annual average reported for the previous 10 years, 1965-74 (table 2). Withdrawals in 1975 for industry were slightly greater than in 1974, chiefly because of the use of new wells. Withdrawals for irrigation and for domestic and stock use did not change from 1974 to 1975, but withdrawal for public supply decreased moderately because greater than average precipitation (figs. 6 and 8) increased the availability of surface supplies.

Water levels rose from February 1975 to February 1976 in about two-thirds of Jordan Valley (fig. 7) and declined in about one-third; the average change in water level in the valley was a rise of about 0.7 ft (0.2 m). The maximum observed rise was 6 ft (1.8 m) about 2 mi (3.2 km) west of Riverton. The maximum observed decline was about 4 ft (1.2 m) in the northeastern part of Salt Lake City. The maximum rises were in areas where the volume of recharge locally was greater than average and where withdrawals from wells were less during 1975 than during 1974. The maximum decline was due to increased pumping at wells used for public supply.

The relation between fluctuations of precipitation and water levels in selected wells is illustrated in figure 8. Precipitation at Silver Lake Brighton during 1975 was 7.17 in (182 mm) above the average for 1931-73. The above-average precipitation is reflected by a rise of water levels in two of the five observation wells. Declines at two of the other wells were due to local pumping.

TOOELE VALLEY

by L. R. Herbert

During 1975, approximately 29,000 acre-ft (36 hm^3) of water was withdrawn from wells in Tooele Valley. This amount is 4,000 acre-ft

(4.9 hm^3) less than reported for 1974 (table 2), but 4,000 acre-ft (4.9 hm^3) more than the average annual withdrawal for the previous 10 years. The decrease in withdrawals was due to above-average precipitation, resulting in a decrease in demand for water from wells pumped for irrigation and public supply.

The discharge from springs in 1975 was approximately 21,000 acre-ft (26 hm^3), a decrease of about 3,000 acre-ft (3.7 hm^3) from the previous year. About 4,000 acre-ft (4.9 hm^3) of the water was used for irrigation and stock in the valley, and about 17,000 acre-ft (21 hm^3) was diverted to the Jordan Valley for industrial use.

Water levels rose in most of the valley from March 1975 to March 1976 (fig. 9) due to above-average precipitation and decreased withdrawals from wells during 1975. Rises of more than 4 ft (1.2 m) occurred in the Erda and Grantsville districts. The maximum water-level declines, which were less than 2 ft (0.6 m) were recorded in the Lake Point district and northern part of the Mill Pond district. These declines may be due to effects of local pumping.

The long-term relation between water levels in selected wells and precipitation at Tooele is shown in figure 10. Water levels rose in most of Tooele Valley in 1975 because of above-average precipitation and less demand for ground water from pumped wells.

UTAH AND GOSHEN VALLEYS

by R. M. Cordova

Withdrawal of water from wells in Utah and Goshen Valleys in 1975 was about 98,000 acre-ft (121 hm^3). This was 8,000 acre-ft (9.9 hm^3) less than reported for 1974 (table 2) but 12,000 acre-ft (15 hm^3) more than the average annual withdrawal for the previous 10 years. Withdrawals in 1975 were significantly less than those in 1974 for irrigation and public supply by 5,800 acre-ft (7.2 hm^3) and 3,300 acre-ft (4.1 hm^3), respectively. In Utah Valley, about 77,000 acre-ft (95 hm^3) of water was withdrawn in 1975, or about 9,000 acre-ft (11 hm^3) less than in 1974; in Goshen Valley, 21,000 acre-ft (26 hm^3) was withdrawn in 1975 or about 1,000 acre-ft (1.2 hm^3) more than in 1974.

Water levels in most observation wells rose from March 1975 to March 1976 (figs. 11-15). The general rise resulted from decreased ground-water withdrawal and above-average precipitation (fig. 15).

JUAB VALLEY

by V. L. Jensen

The withdrawal of water from wells in Juab Valley during 1975 was about 25,000 acre-ft (31 hm^3), a decrease of 6,000 acre-ft (7.4 hm^3) from that reported for 1974 (table 2). The decrease in withdrawals was a result of greater availability of surface water and increased precipitation in 1975. Withdrawals in 1975 were above the 1965-74 average (table 2) because, though precipitation was greater than in 1974, it was still well below the 10-year average.

From March 1975 to March 1976, water levels rose throughout most of the valley (fig. 16) as a result of decreased withdrawals and increased recharge. Declines were observed around Levan and west of Mona where withdrawals locally exceeded recharge.

The relation of water levels in selected wells and the cumulative departure from the 1935-73 average precipitation at Nephi is shown in figure 17. Precipitation at Nephi for 1975 was 10.54 in (268 mm) compared with 9.29 in (236 mm) for 1974 and the 1935-73 average of 13.79 in (350 mm).

SEVIER DESERT

by R. W. Mower

The withdrawal of water from wells in the Sevier Desert in 1975 was about 26,000 acre-ft (32 hm^3). This amount was 1,000 acre-ft (1.2 hm^3)--about 4 percent--more than was reported for 1974 and the same as the average annual withdrawal for the previous 10 years, 1965-74 (table 2). The increase from 1974 to 1975 was due chiefly to pumpage for irrigation of lands that had insufficient irrigation supplies from surface-water sources. Withdrawals in 1975 were the same as the annual average for the previous 10 years because available surface-water supplies in 1975 were as plentiful as the previous 10-year average. During 1975, discharge of the Sevier River near Juab, the nearest gaging station above all diversions in the Sevier Desert, was about 158,800 acre-ft (196 hm^3) (fig. 20). This was 68,700 acre-ft (85 hm^3), or about 30 percent less than during 1974, and about 17,850 acre-ft (22 hm^3), or about 13 percent more than the annual average discharge for 1935-75.

Water levels declined from March 1975 to March 1976 in 80 percent of the lower artesian aquifer and in 50 percent of the upper artesian aquifer in the parts of the Sevier Desert covered by the observation-well network (figs. 18 and 19). The maximum observed water-level decline in the lower aquifer was 3.2 ft (1.0 m) about 3 mi (4.8 km) southwest of Leamington. The maximum observed decline in the upper artesian aquifer was 3.0 ft (0.9 m) near the north edge of Pavant Valley about 10 mi (16 km) southeast of Delta.

Water levels rose a maximum of slightly more than 2 ft (0.6 m) in wells in the lower artesian aquifer about 5 mi (8.0 km) south of Delta, about 4 mi (6.4 km) south of Leamington, and about 1 mi (1.6 km) north of Oak City. A similar maximum water-level rise was observed in wells in the upper artesian aquifer about 4 mi (6.4 km) south of Leamington and about 2 mi (3.2 km) north of Oak City.

The long-term relation between precipitation at Oak City, discharge of the Sevier River near Juab, and water levels in selected wells is shown in figure 20. Precipitation at Oak City in 1975 was 3.31 in (84 mm) above the 1935-73 average. The water level declined in one observation well from March 1975 to March 1976, indicating that the withdrawal from wells in 1975 exceeded the recharge in some parts of the Sevier Desert.

SANPETE VALLEY

by M. D. ReMillard

Approximately 15,000 acre-ft (18 hm^3) of water was withdrawn from wells in Sanpete Valley during 1975. This is less than the 17,000 acre-ft (21 hm^3) withdrawn in 1974 and less than the average annual withdrawal of 16,000 acre-ft (30 hm^3) for the period 1965-74 (table 2). Withdrawals of water from irrigation wells during 1975 were less than in 1974 because precipitation was greater, although still less than average (fig. 22), and more surface water was available for irrigation.

From March 1975 to March 1976, water levels rose in most of Sanpete Valley (fig. 21). The decline of water levels locally in the valley probably was due to the effect of withdrawals from wells.

Long-term hydrographs of water levels in three wells in Sanpete Valley and the long-term trend of precipitation at Manti are shown in figure 22. Water-level rises in two of the wells from March 1975 to March 1976 reflect increased recharge from surface-water applications and increased precipitation and reduced withdrawals from wells during the period. The decline of water level in the well southwest of Chester may be due to effect of withdrawals of nearby wells.

THE UPPER AND CENTRAL SEVIER VALLEYS

by G. W. Sandberg

The withdrawal of water from wells in the upper and central Sevier Valleys was about 20,000 acre-ft (25 hm^3) in 1975. This was about the same as in 1974 and 1,000 acre-ft (1.2 hm^3) more than the average annual withdrawal for the previous 10 years (table 2).

Water levels rose in 11 observation wells, declined in 13 wells, and remained unchanged in 2 wells from March 1975 to March 1976 (fig. 23). The largest observed rise, 3.9 ft (1.2 m), was east of the Sevier River, about 4 mi (6.4 km) north of Panguitch; and the greatest observed decline, 2.0 ft (0.6 m), was on the west side of the Sevier River about 2 mi (3.2 km) west of the well with the largest rise. Most of the declines were in the central Sevier Valley.

The relation of water levels in selected wells to discharge of the Sevier River at Hatch and precipitation at Salina and Panguitch is shown in figure 24. Precipitation was 0.24 in (6 mm) above the 1935-73 average at Salina and 1.33 in (34 mm) below the average at Panguitch. Discharge of the Sevier River at Hatch was about 40 percent greater in 1975 than in 1974, but it was still 13,000 acre-ft (16 hm^3) below the 1940-73 average.

PAVANT VALLEY

by C. T. Sumsion

Withdrawal of water from wells in Pavant Valley in 1975 was 98,000 acre-ft (121 hm^3), which was 3,000 acre-ft (3.7 hm^3) less than reported for 1974, but 19,000 acre-ft (23 hm^3) more than the 1965-74 average (table 2). Precipitation was slightly above average, and more surface water was available for irrigation during 1975.

From March 1975 to March 1976, water levels declined in about 55 percent of the area where data are available (fig. 25), owing chiefly to ground-water withdrawals in excess of recharge during 1975 as well as the previous year. The maximum measured decline was 10.61 ft (3.23 m) in a well about 3 mi (4.8 km) northwest of Holden. Water levels generally rose in the area extending from near Holden to Fillmore and also in the southwestern part of the area, where recharge was locally in excess of pumpage. The maximum measured rise was 10.02 ft (3.05 m) in a well about 6 mi (9.6 km) west of Kanosh.

The relation between water levels in selected wells and cumulative departure from the 1931-73 average precipitation at Fillmore is shown in figure 26. Water levels declined in four of the observation wells and rose in three wells, whereas precipitation increased slightly.

Some of the water pumped for irrigation in Pavant Valley returns to the ground-water system as recharge and is then withdrawn again for irrigation. Such recirculation of ground water affects its chemical quality (Handy and others, 1969, p. D228-D234). The concentration of dissolved solids in 1975, in comparison to the most recent earlier measurement, was greater in water from four observation wells, and less in water from the well in the Meadow district aquifer. However, the general trend since at least 1957 is toward increasing concentrations of dissolved solids as shown in figure 27.

CEDAR CITY VALLEY

by L. J. Bjorklund

Approximately 28,000 acre-ft (35 hm^3) of water was pumped from wells in Cedar City Valley during 1975. This compares with 42,000 acre-ft (52 hm^3), the largest annual withdrawal recorded, in 1974, and the 1965-74 average annual withdrawal of 29,000 acre-ft (36 hm^3) (table 2). The substantial decrease in pumpage in relation to 1974 was primarily a result of the greater availability of surface water in Coal Creek for irrigation during the growing season of 1975. Heavy rains during midsummer of 1975 also contributed to the decrease in irrigation pumpage.

During 1975, both rises and declines of water levels in wells took place in Cedar City Valley. Rises of more than 3 ft (0.9 m) occurred in midvalley northwest of Cedar City and rises of more than 1 ft (0.3 m) were observed in the southern part of the valley near Kanarraville (fig. 28). Water levels declined in most of the valley, with maximum declines of more than 3 ft (0.9 m) observed near Enoch and near Hamilton Fort. The rises in water levels were in the areas of greatest decline during 1974 (Eychaner and others, 1975, fig. 28). However, the rises during 1975 were less than declines during 1974, resulting in a net general decline in the area for the 2-year (1974-76) period. Rises in water level were caused by recharge from surface water used for irrigation and from ponded runoff in shallow depressions and pits on the land surface in midvalley northeast of Cedar City following heavy midsummer rains. Declines were caused mainly by pumping for irrigation.

Graphs in figure 29 show long-term water-level changes in an observation well 3 mi (4.8 km) northwest of Cedar City, cumulative departure from average annual precipitation, annual discharge of Coal Creek, and annual pumpage in the Cedar City Valley. The graphs indicate that slightly higher than average precipitation during 1975 is related to a small rise in water level in the well, to an increase in the discharge of Coal Creek, and to a decrease in pumpage from wells.

PAROWAN VALLEY

by L. J. Bjorklund

During 1975, approximately 28,000 acre-ft (35 hm^3) of water was discharged from wells in Parowan Valley as compared to 31,000 acre-ft (38 hm^3) in 1974 and the 1965-74 average annual withdrawal of 23,000 acre-ft (28 hm^3) (table 2). Pumpage in 1975 was the second highest on record, having been exceeded only by pumpage in 1974 (fig. 31). The relatively high pumpage in 1975 is attributed to less than average precipitation and pumping for irrigation during a longer than average growing season.

Ground-water levels declined everywhere in the valley between March 1975 and March 1976. Declines ranged from less than 1 ft (0.3 m) in the northern part of the valley to more than 4 ft (1.2 m) in areas about 3 mi (4.8 km) northwest of Parowan and 3 mi (4.8 km) northeast of Paragonah (fig. 30). Water levels declined more than 2 ft (0.6 m) in an area of about 30 mi^2 (78 km^2) in the southern half of the valley. The sum of declines for 1974-76 (Eychaner and others, 1975, figs. 30 and 31) are roughly equal to rises in water levels during 1973-74 (Stephens and others, 1974, fig. 32), resulting in water levels in March 1976 that were near those in March 1973.

Water levels declined in 1975 for the second consecutive year as a result of pumping from wells for irrigation during a relatively long growing season. The greatest declines were in heavily pumped areas in the southern half of the valley. Less than average precipitation during the year resulted in less than average recharge to the ground-water reservoir, and this also contributed to the decline of ground-water levels.

Figure 31 shows the long-term relation of water levels in an observation well near Paragonah, cumulative departure from average precipitation, and annual withdrawal from wells in the valley. The graphs show that precipitation has been above average during most years since 1960 but below average in 1974 and 1975. Pumpage from wells since 1960, on the other hand, has increased fairly steadily. The hydrograph of well (C-34-8)5bca-1 shows the effects of departure from average precipitation rather than the effects of ground-water development, probably because the well is not greatly influenced by drawdown of water levels in the heavily pumped area to the west.

ESCALANTE VALLEY

Milford area

by R. W. Mower

The withdrawal of water from wells in the Milford area in 1975 was about 60,000 acre-ft (74 hm^3). It was 10,000 acre-ft (12 hm^3)--14 percent--less than was reported for 1974, but 6,000 acre-ft (7.4 hm^3) more than the average annual withdrawal for the previous 10 years, 1965-74 (table 2). The decrease from 1974 to 1975 was due to a decrease in pumpage for irrigation, although less surface water was available than in 1974. During 1975, discharge of the Beaver River at Rockyford Dam, near Minersville (fig. 33) was about 16,700 acre-ft (20.6 hm^3), about 50 percent less than during 1974, and about 9,000 acre-ft (11.1 hm^3)--about 35 percent--less than the annual average for 1932-73. Precipitation during 1975 was 2.69 in (68 mm) more than during 1974. Most of the increase occurred during the irrigation season, which is largely the reason withdrawals for irrigation during 1975 were less than in 1974.

Water levels declined from March 1975 to March 1976 in about 51 percent of the Milford area (fig. 32). The average change in water level in the area was a decline of 0.5 ft (0.15 m). The maximum observed decline was slightly more than 2 ft (0.6 m) in two small areas about 1-3 mi (1.6-4.8 km) south-southeast of Milford and about 1-6 mi (1.6-16 km) north of Minersville. The maximum observed rises were less than 1 ft (0.3 m) in about 49 percent of the area extending from about the northeast corner of Milford east and north to the northern edge of the valley. The major declines from March 1975 to March 1976 were due to above average pumping locally for irrigation and to reduced recharge from canals and fields irrigated with surface water. Water levels rose in areas where there was no increase in pumping and where recharge was greater than normal due to greater than normal precipitation.

The relations between water levels in well (C-29-10)6ddc-2 near the middle of the pumped area, precipitation at Milford airport, discharge of the Beaver River, and ground-water withdrawals are shown in figure 33. Precipitation at Milford airport in 1974 was 0.68 in (17 mm) above the 1932-73 average. The decline of water levels caused by the increased withdrawals and the decreased availability of surface water is represented by the water-level decline in well (C-29-10)6ddc-2.

BERYL-ENTERPRISE AREA

by G. W. Sandberg

The withdrawal of water from wells in the Beryl-Enterprise area in 1975 was about 85,000 acre-ft (105 hm^3), a decrease of 8,000 acre-ft (9.9 hm^3) from the amount reported for 1974 (table 2). The withdrawal of water from wells in 1975 was the second largest annual withdrawal ever recorded and was 8,000 acre-ft (9.9 hm^3) more than the average annual withdrawal for the previous 10 years. The decrease from 1974 to 1975 was due to decreased pumping for irrigation. Withdrawals from wells for public supply increased but withdrawals remained about the same as 1974 for industrial and domestic use.

Water levels declined throughout the entire area except for small areas southwest of Enterprise and near Newcastle (fig. 34). The rise in the vicinity of Enterprise was probably caused by recharge from flow in a small stream that is usually dry. The rise near Newcastle was probably the result of less pumpage in this area.

The long-term relation between water levels in selected wells, precipitation, and pumpage for irrigation is shown in figure 35. Precipitation was above the 1935-73 average, and this may have contributed to the decrease in pumpage. The water level in well (C-35-17)25dcd-1 declined less from March 1975 to March 1976 than during the previous year, probably because less water was pumped for irrigation during 1975 than in 1974. Water-level declines were generally larger toward the southern end of the valley. The largest decline, 4.4 ft (1.3 m), was in a well about 1.5 mi (2.4 km) northeast of Enterprise, but this decline was only one-fourth of the decline observed in that well during the previous year.

Figure 36 shows the change in concentration of dissolved solids in the water from four wells. The concentration increased in three wells in the northern, central, and eastern parts of the area, but decreased in the southern part of the area. The increases were probably caused by continued recycling of irrigation water, whereas the decrease was probably caused by freshwater moving into the area from the south.

BEAVER VALLEY

by R. W. Mower

The withdrawal of water from wells in Beaver Valley in 1975 was about 8,000 acre-ft (9.9 hm^3). The 1975 withdrawal was 2,000 acre-ft (2.5 hm^3)--about 20 percent--less than was withdrawn during 1974, but 2,000 acre-ft (2.5 hm^3) more than the average annual withdrawal for the previous 10 years, 1965-74 (table 2). The long-term increase was due chiefly to an increase in pumpage for irrigation because more land continually is being brought under irrigation with water from wells. Water from some wells is used to supplement irrigation supplies from surface streams and other wells furnish the sole irrigation supply. During

1975, discharge of the Beaver River near Beaver (fig. 39) was about 28,900 acre-ft (35.6 hm^3), which was about 6,900 acre-ft (8.5 hm^3) or 19 percent less than the annual average for 1935-75.

Water levels declined from March 1975 to March 1976 in about 40 percent of the part of Beaver Valley covered by the observation-well network (fig. 37); the average change in water level in the area was a decline of 0.2 ft (0.06 m). The maximum observed decline was slightly more than 11 ft (3.4 m) at a well at the north edge of Beaver. The maximum observed rise was slightly more than 2 ft (0.6 m) at a well about 1.5 mi (2.4 km) south of Greenville. Figure 38 shows the altitude of the water level in March 1976 in the part of Beaver Valley where development of ground-water for irrigation is greatest.

The long-term relations between water levels in well (C-29-7) 21baa-1 at the west edge of Beaver and near the middle of the valley, precipitation at Beaver, discharge of the Beaver River, and ground-water withdrawals are shown in figure 39. The graphs show that precipitation has been only slightly above the 1935-73 average since 1964, and in 1975 it was 0.51 in (13 mm) above average. Withdrawals from wells generally have increased, but there have been fairly large yearly fluctuations that show the effect of precipitation and availability of surface water. The hydrograph of the observation well shows little long-term effect from either precipitation or pumping as there is more than ample water during most years to fully recharge the ground-water reservoir in this part of Beaver Valley.

OTHER AREAS

by L. R. Herbert

Approximately 81,000 acre-ft (100 hm^3) of water was withdrawn from wells in areas of Utah outside of the major developed ground-water basins. This amount is about 15,000 acre-ft (19 hm^3) less than reported in 1974, but 23,000 acre-ft (28 hm^3) more than the 1965-74 average (table 2). The decrease in withdrawals from wells in 1975 was due mainly to increased precipitation in most areas.

Ground-water levels rose in most of these areas from March 1975 to March 1976. The rise in water levels was caused by increased precipitation and decreased withdrawals from wells.

Water levels declined in a few areas where there were locally heavy withdrawals of ground water.

Estimated total withdrawals of water in 1975 from wells in areas of Utah other than the major developed ground-water basins described in preceding sections were as follows:

	Area (see fig. 1)	Estimated withdrawal (acre-ft)
1.	Grouse Creek valley	2,300
2.	Park Valley	1,600
3.	Curlew Valley	20,000
8.	Ogden Valley	11,000
12.	Dugway area (including Skull Valley north of area outlined in fig. 1)	4,200
13.	Cedar Valley	3,500
23.	Snake Valley	9,600
33.	Central Virgin River area	12,000
	Remainder of State	17,000
	Total (rounded)	81,000

Figure 40 shows the relation of the long-term hydrographs of selected wells in other areas to the cumulative departure from average annual precipitation at sites in or near those areas.

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ILLUSTRATIONS

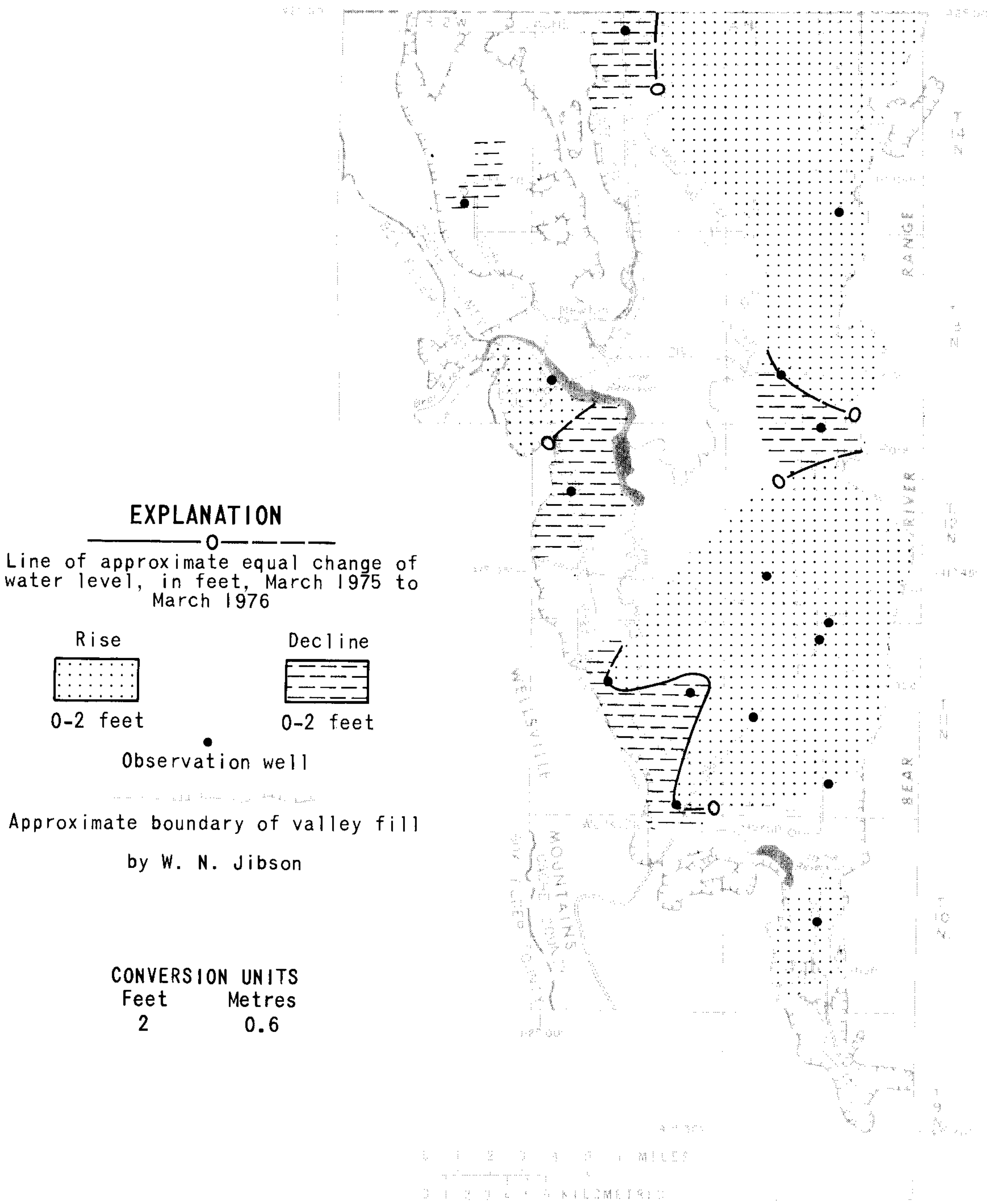


Figure 2.—Map of Cache Valley showing change of water levels from March 1975 to March 1976.

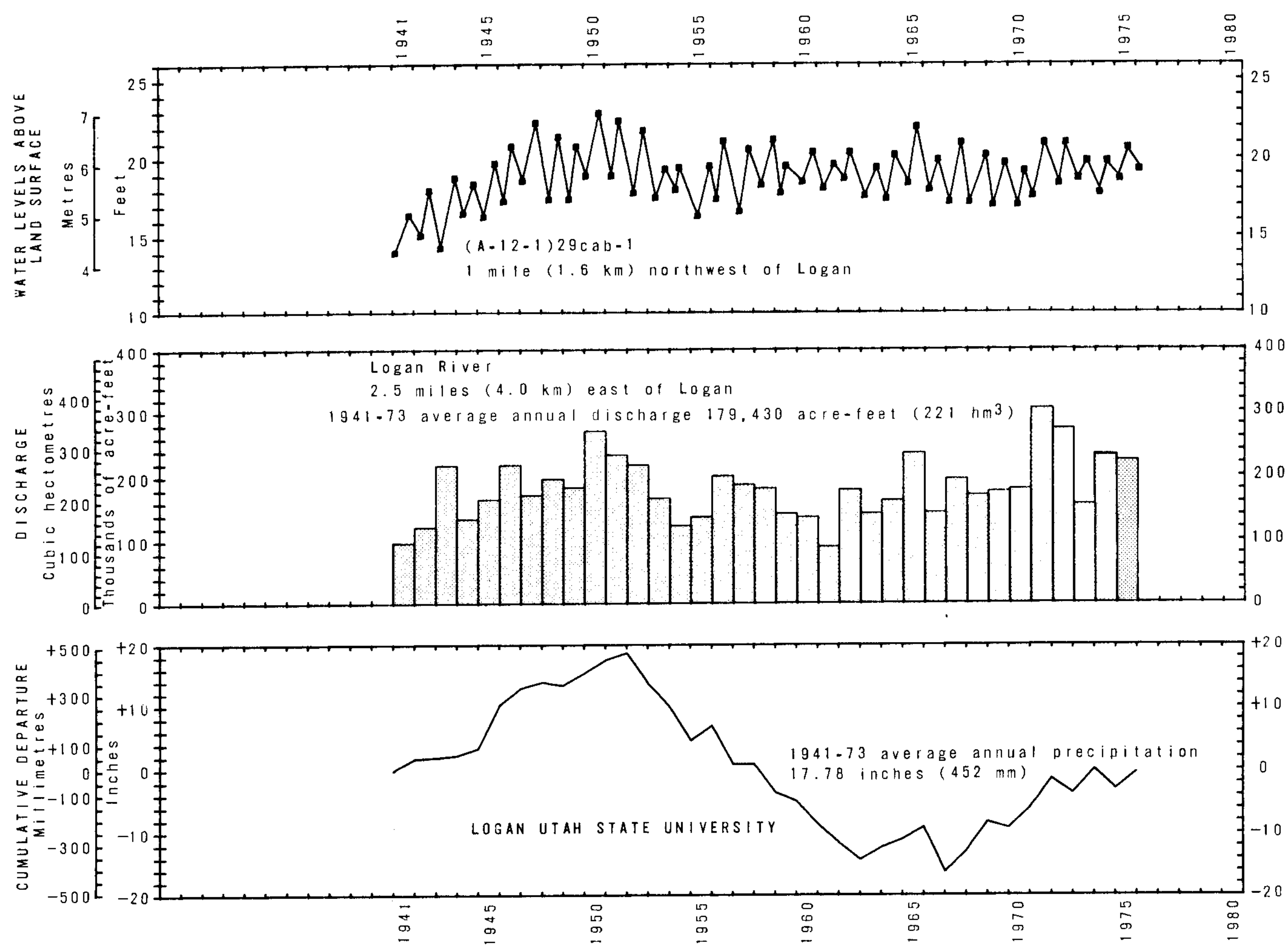


Figure 3.—Relation of water levels in well (A-12-1)29cab-1 in Cache Valley to discharge of the Logan River near Logan and to cumulative departure from the average annual precipitation at Logan Utah State University.

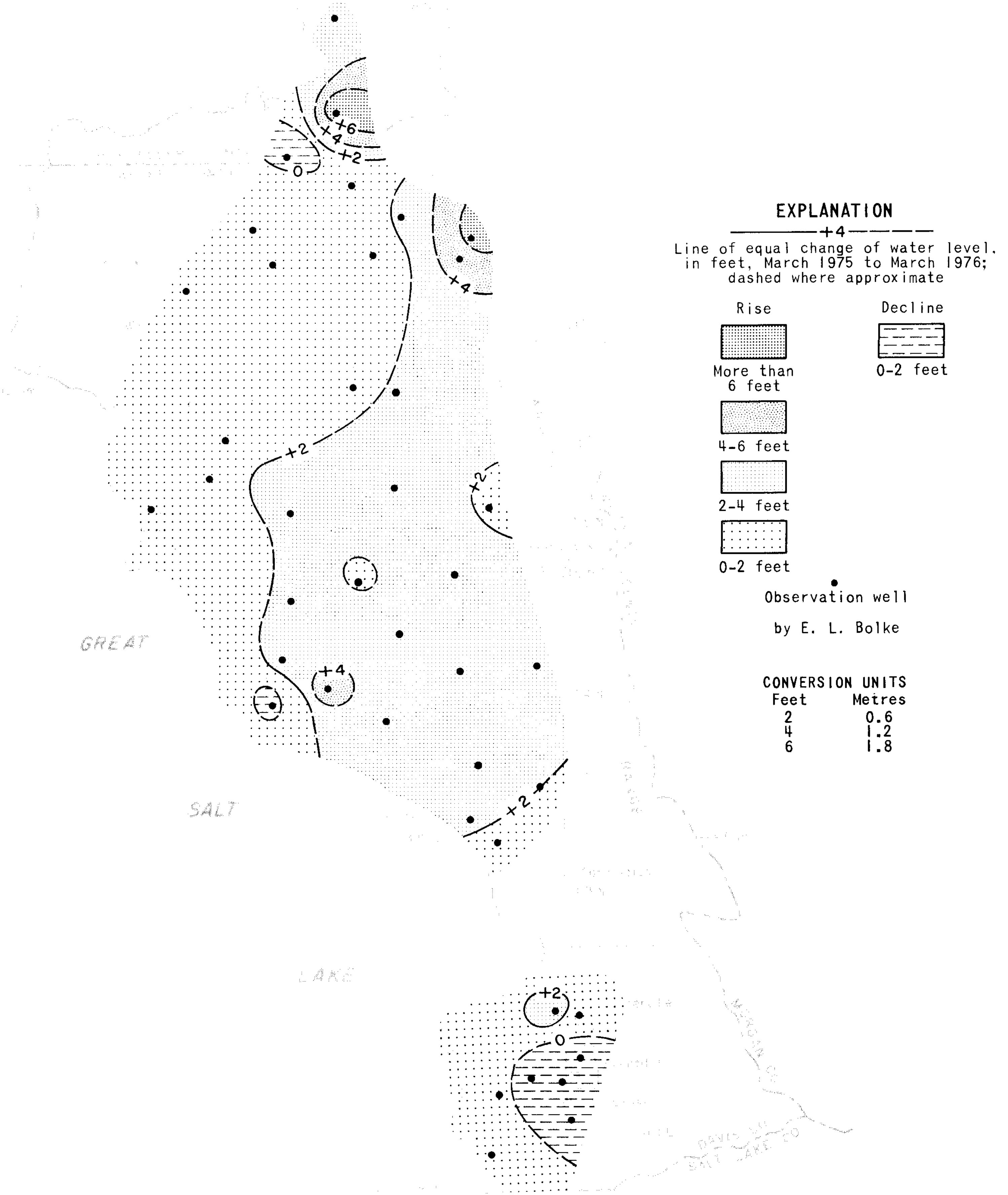


Figure 4.—Map of the East Shore area showing change of water levels from March 1975 to March 1976.

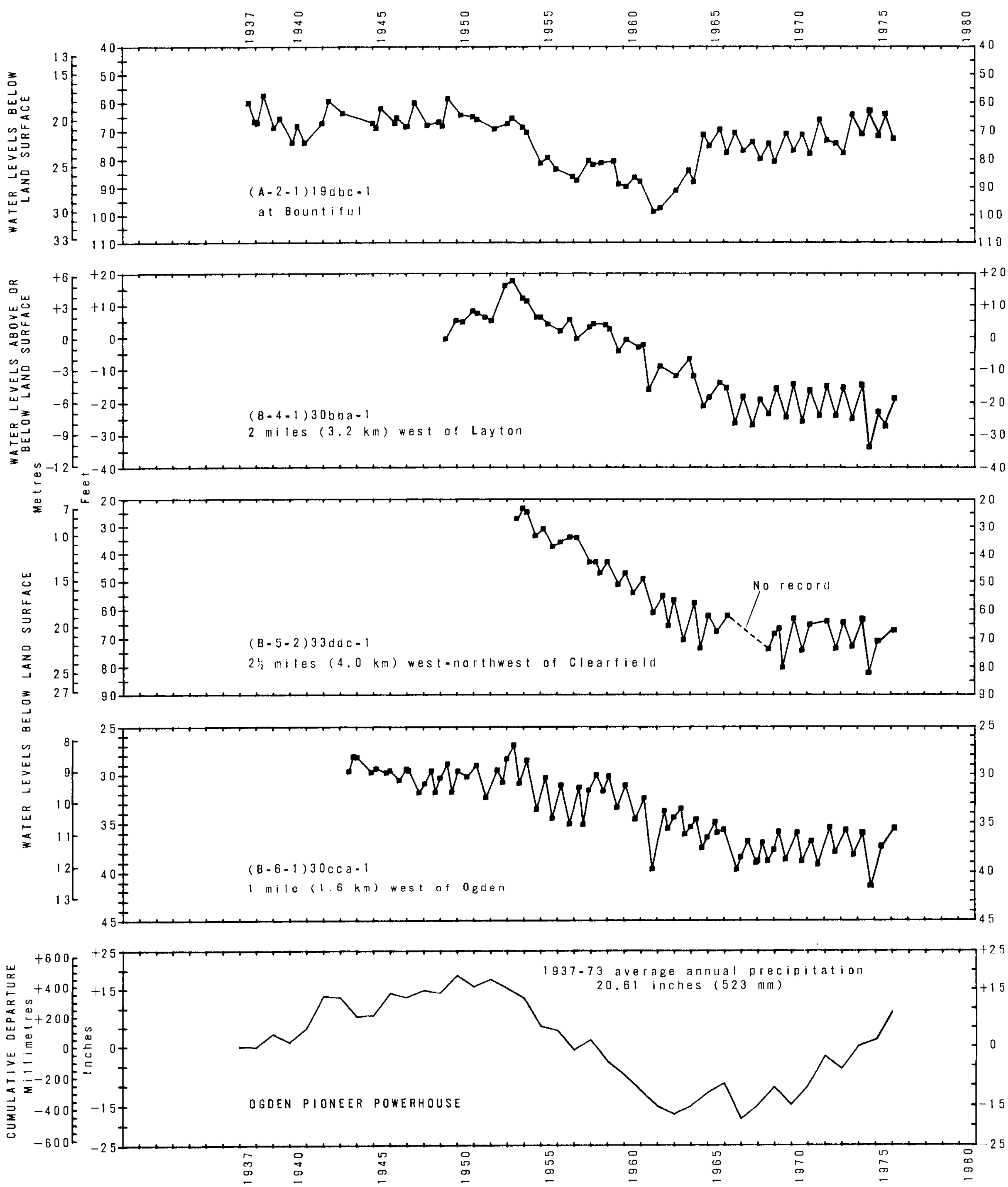


Figure 5.—Relation of water levels in selected wells in the East Shore area to cumulative departure from the average annual precipitation at Ogden Pioneer powerhouse.

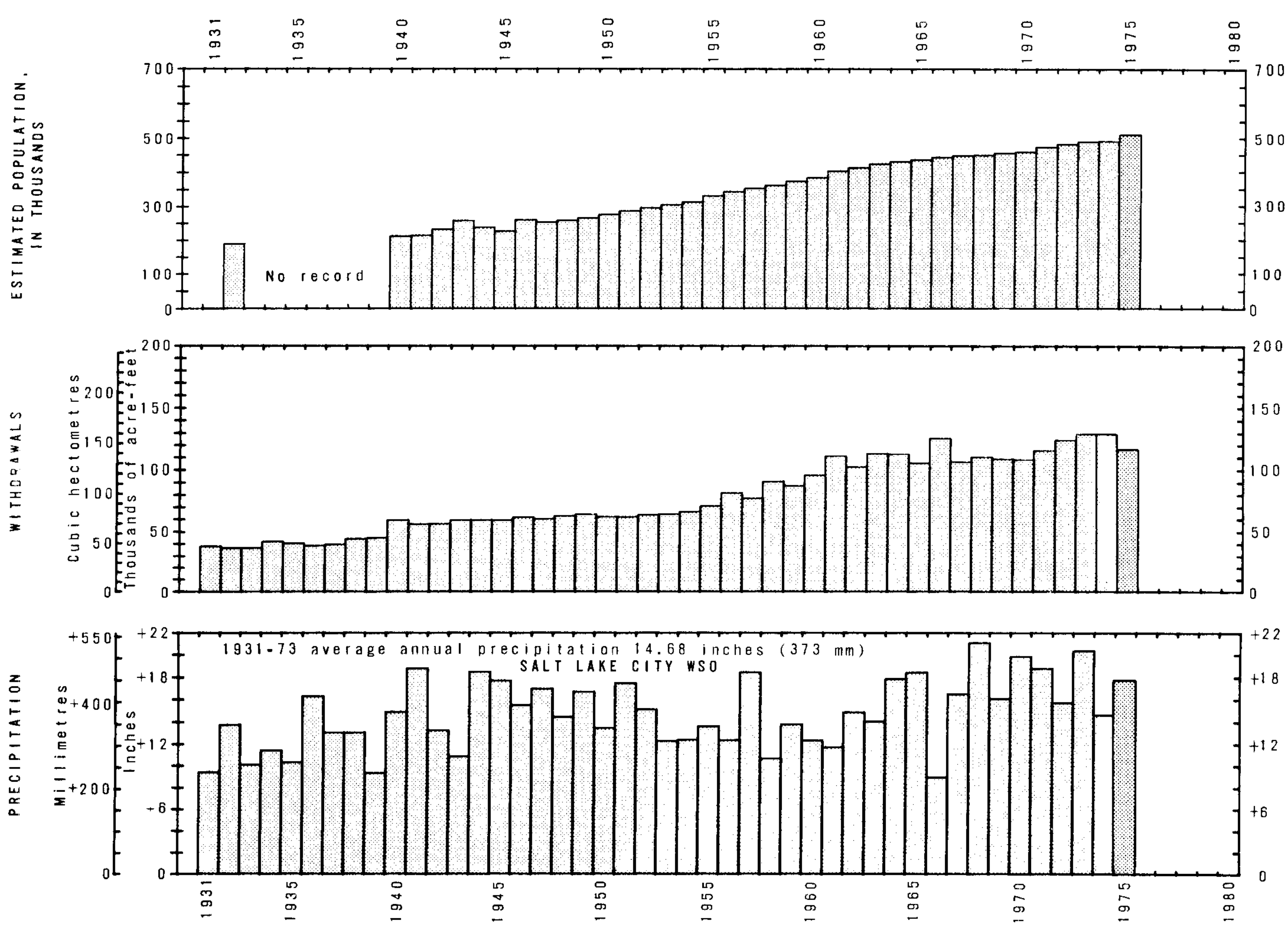


Figure 6.—Graphs showing estimated population of Salt Lake County, withdrawals from wells, and annual precipitation at Salt Lake City WSO (International Airport) for the period 1931-74.

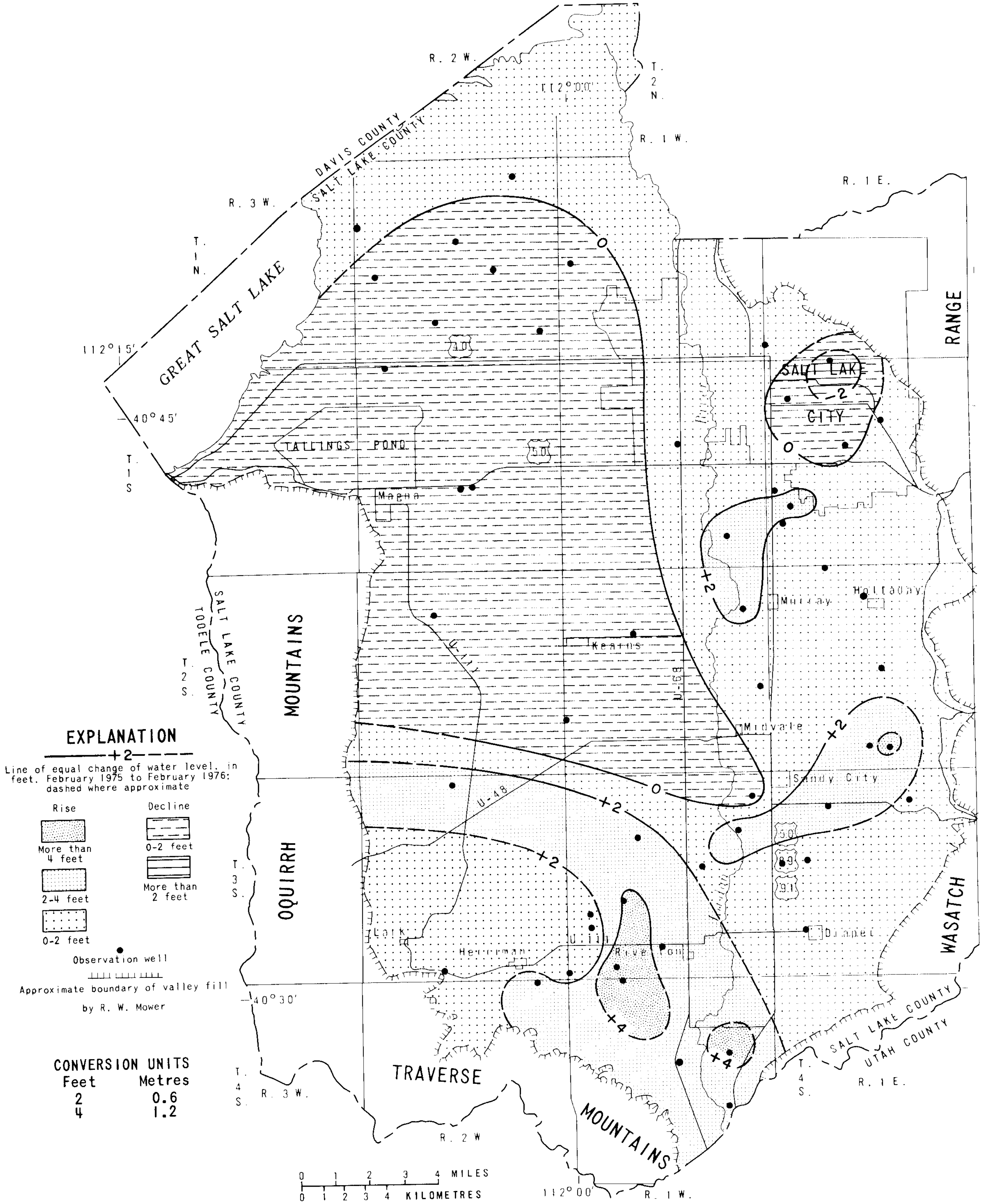


Figure 7.—Map of the Jordan Valley showing change of water levels from February 1975 to February 1976.

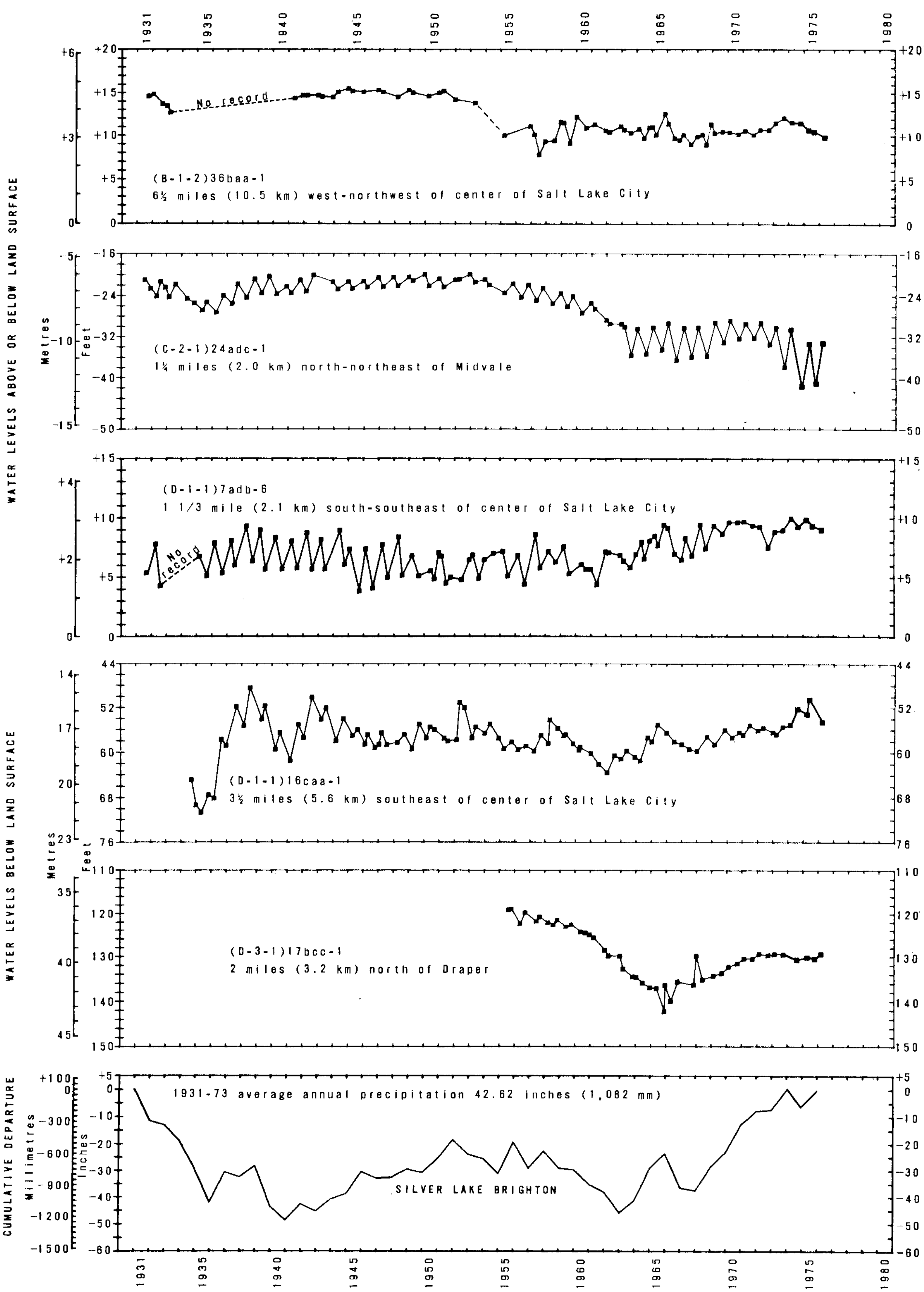


Figure 8.—Relation of water levels in selected wells in the Jordan Valley to cumulative departure from the average annual precipitation at Silver Lake Brighton.

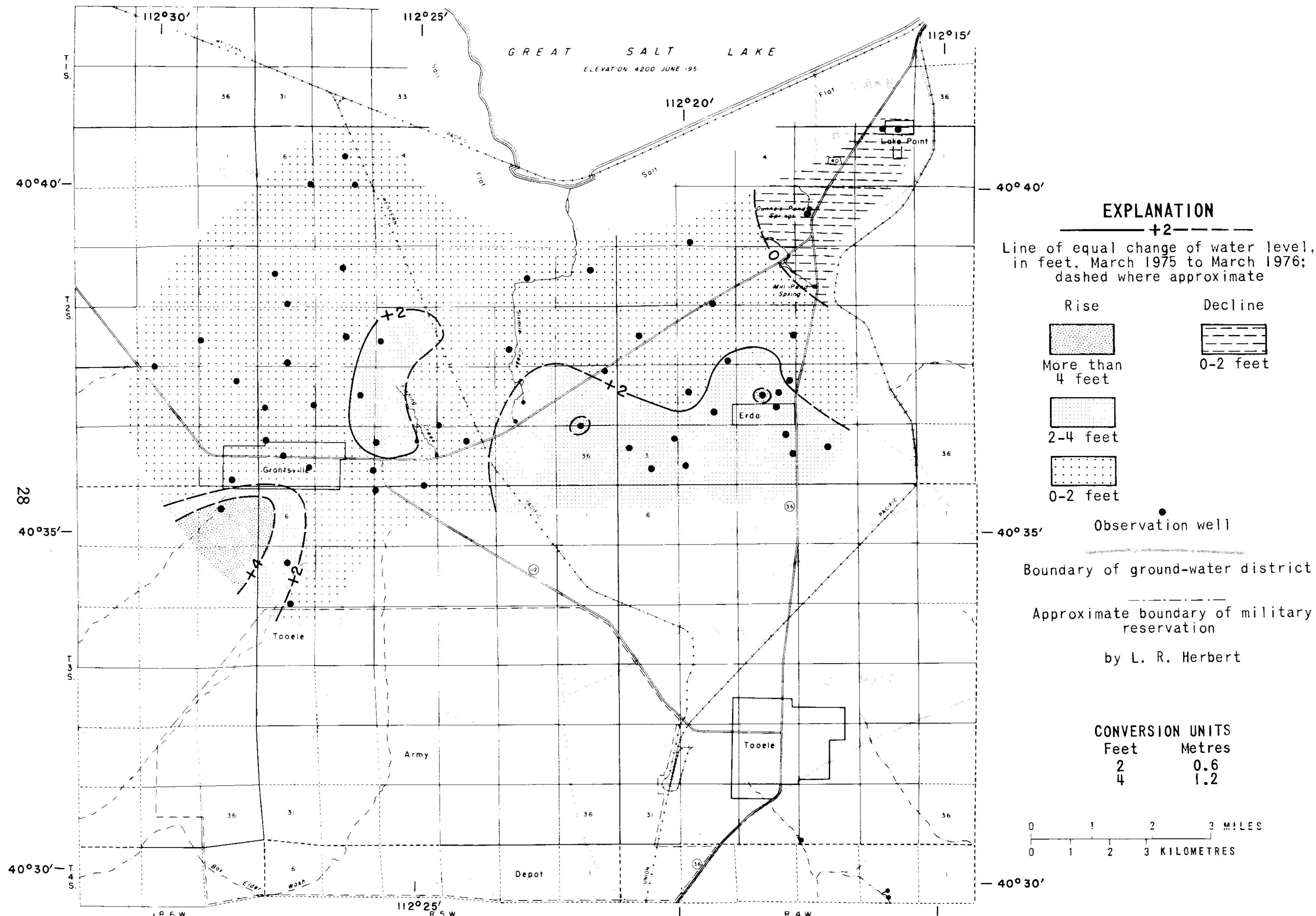


Figure 9.—Map of Tooele Valley showing change of water levels in artesian aquifers from March 1975 to March 1976.

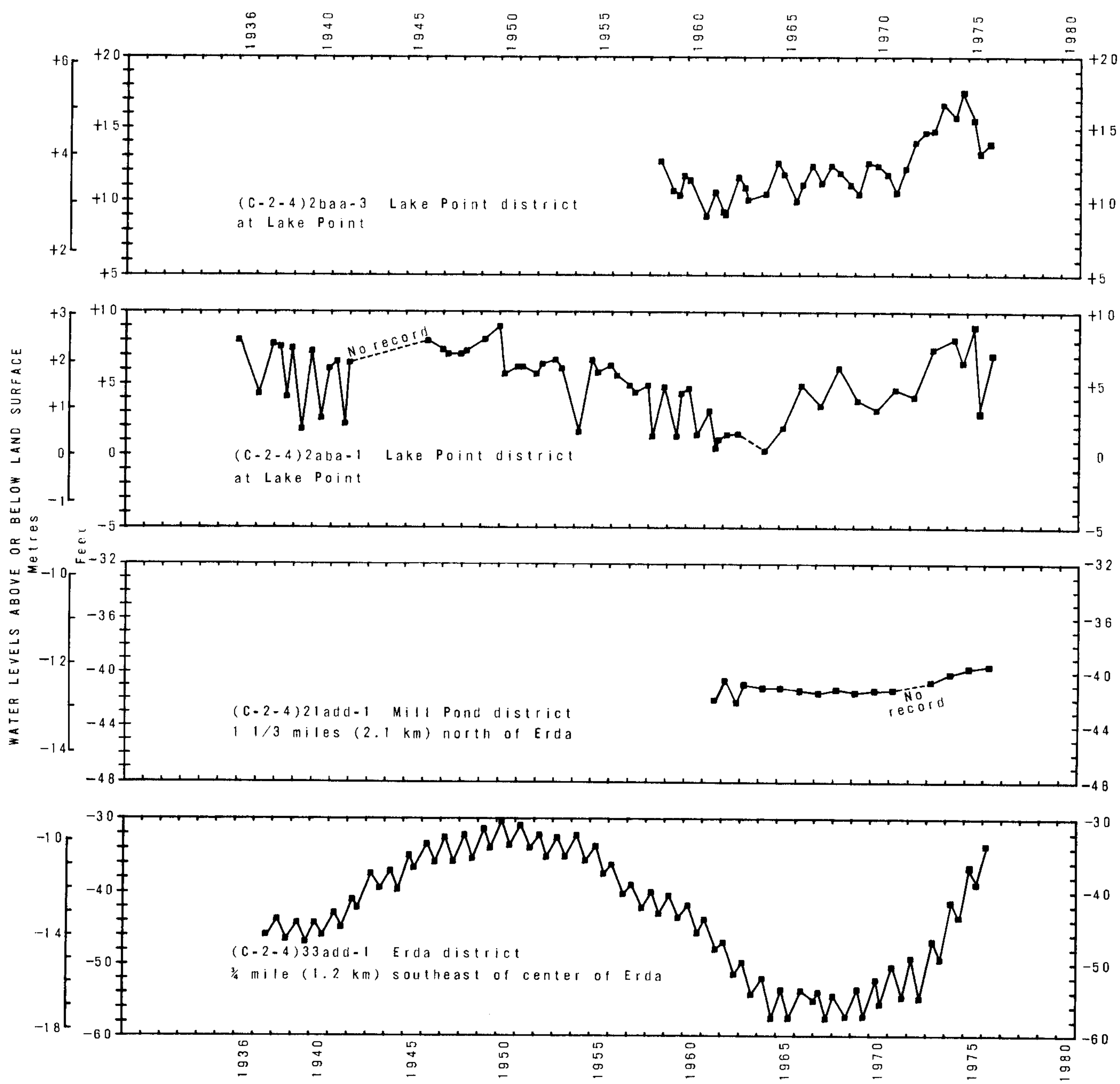


Figure 10.—Relation of water levels in selected wells in Tooele Valley to cumulative departure from the average annual precipitation at Tooele.

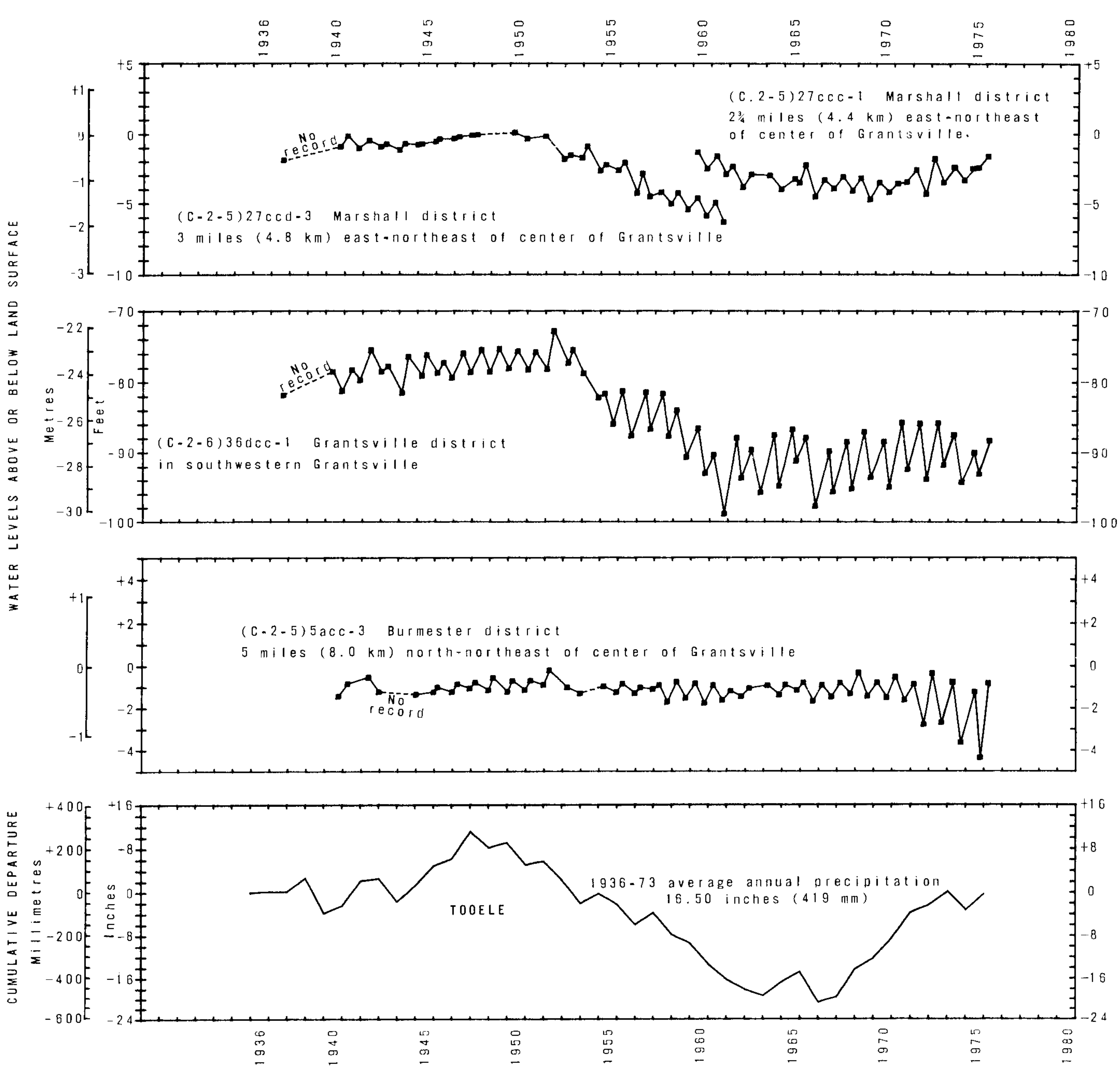


Figure 10.— Continued.

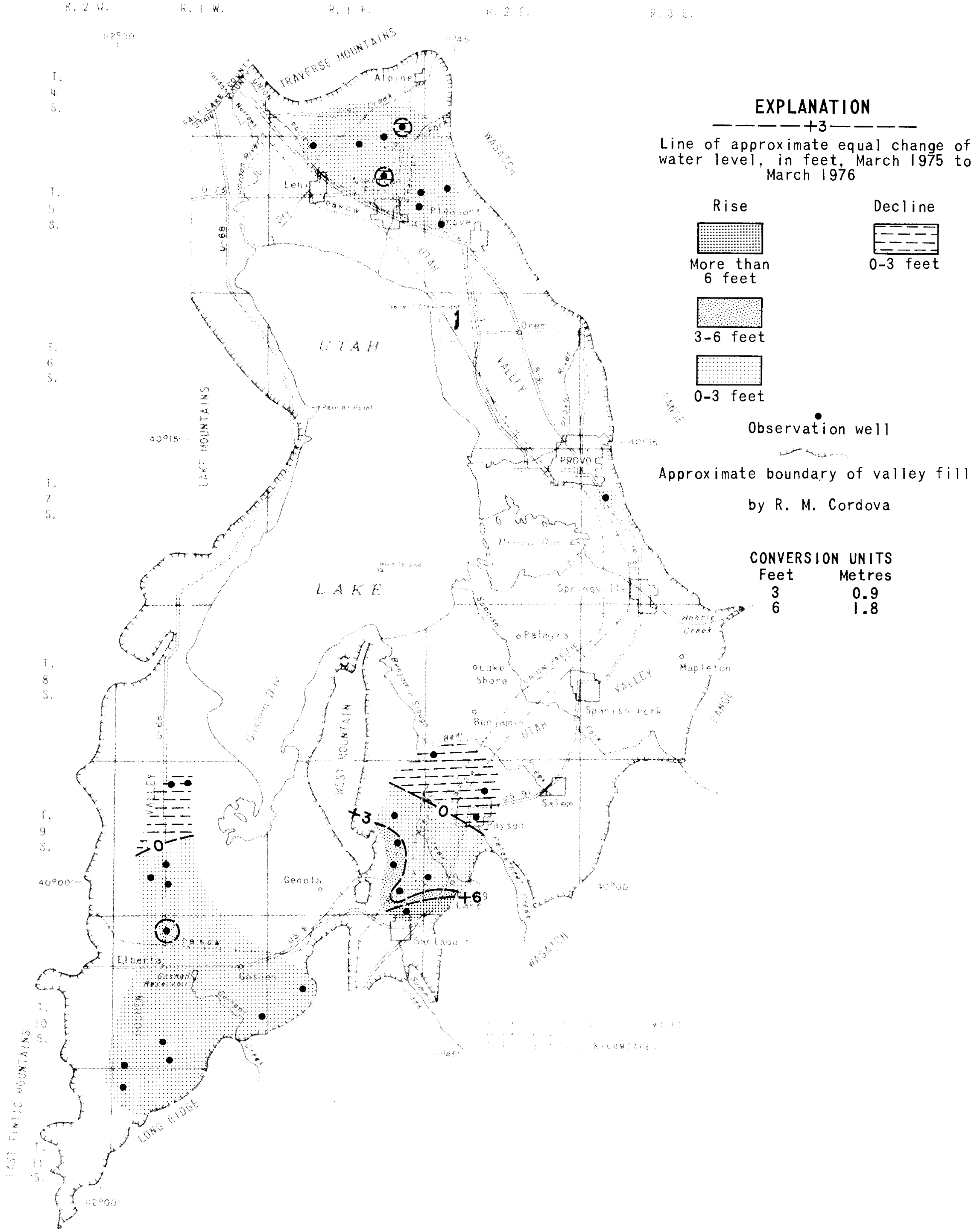


Figure 11.—Map of Utah and Goshen Valleys showing change of water levels in the water-table aquifers from March 1975 to March 1976.

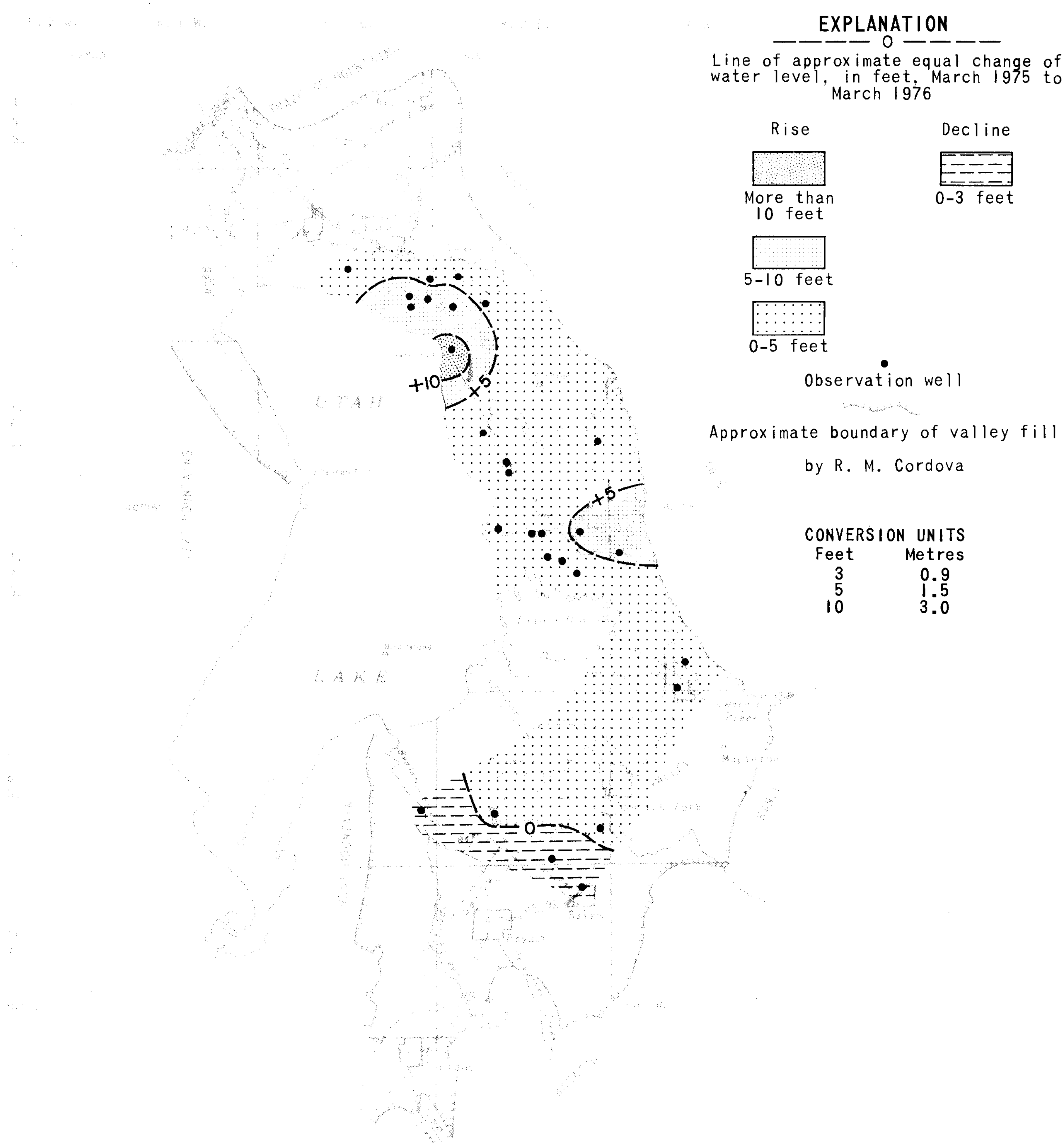


Figure 12.—Map of Utah Valley showing change of water levels in the shallow artesian aquifer in rocks of Pleistocene age from March 1975 to March 1976.

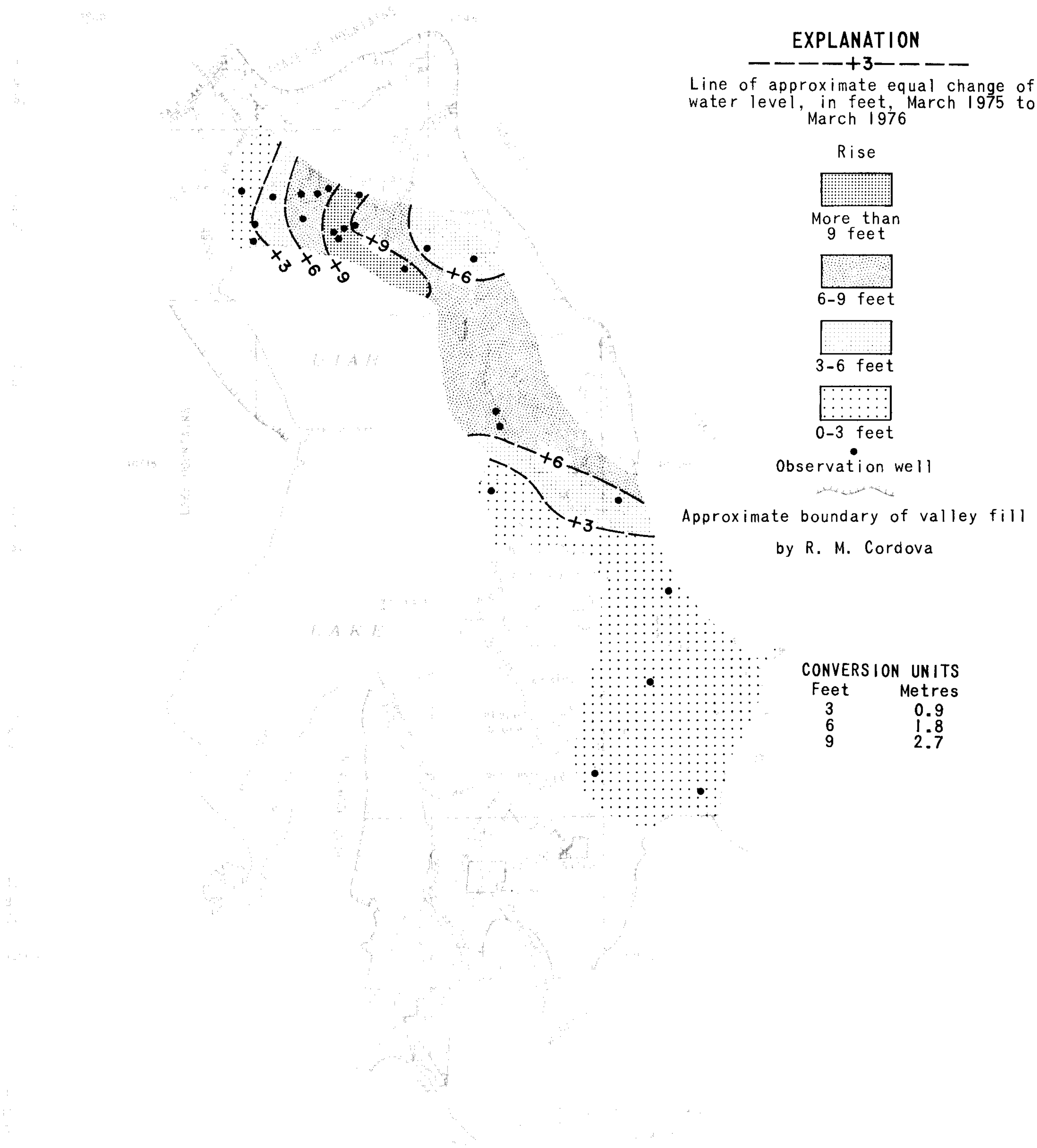


Figure 13.—Map of Utah Valley showing change of water levels in the deep artesian aquifer in rocks of Pleistocene age from March 1975 to March 1976.

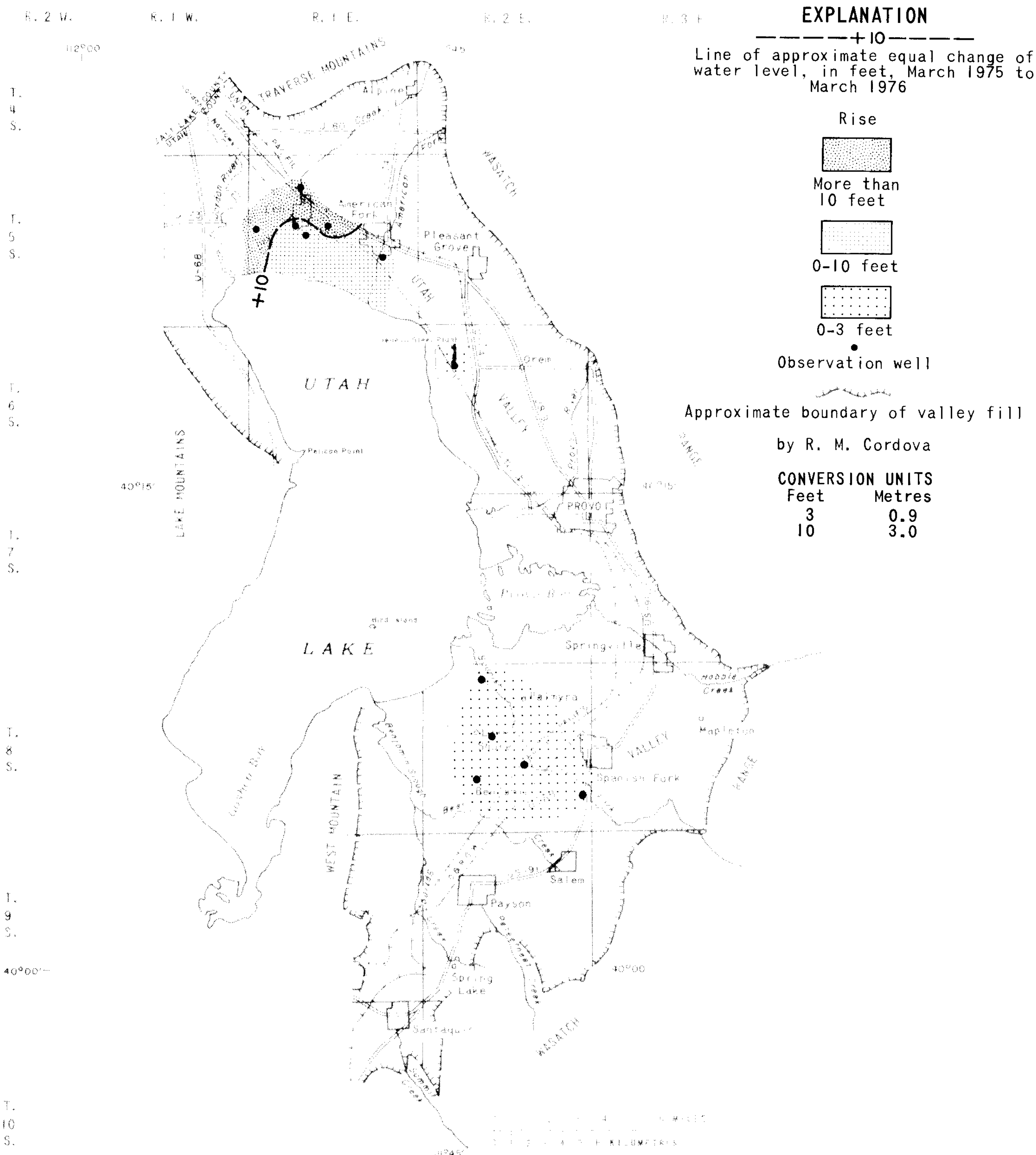


Figure 14.—Map of Utah Valley showing change of water levels in the artesian aquifer in rocks of Tertiary age from March 1975 to March 1976.

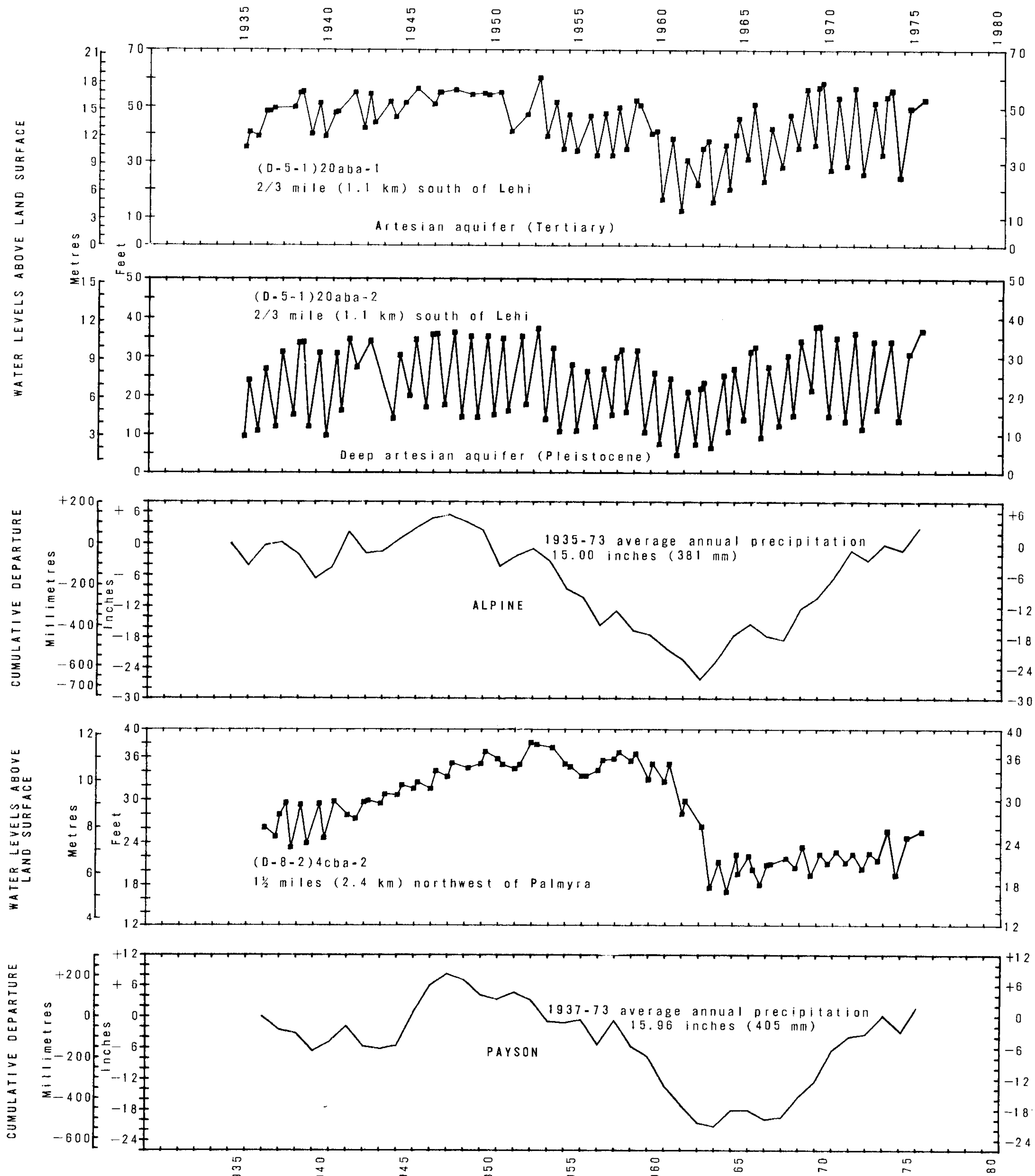
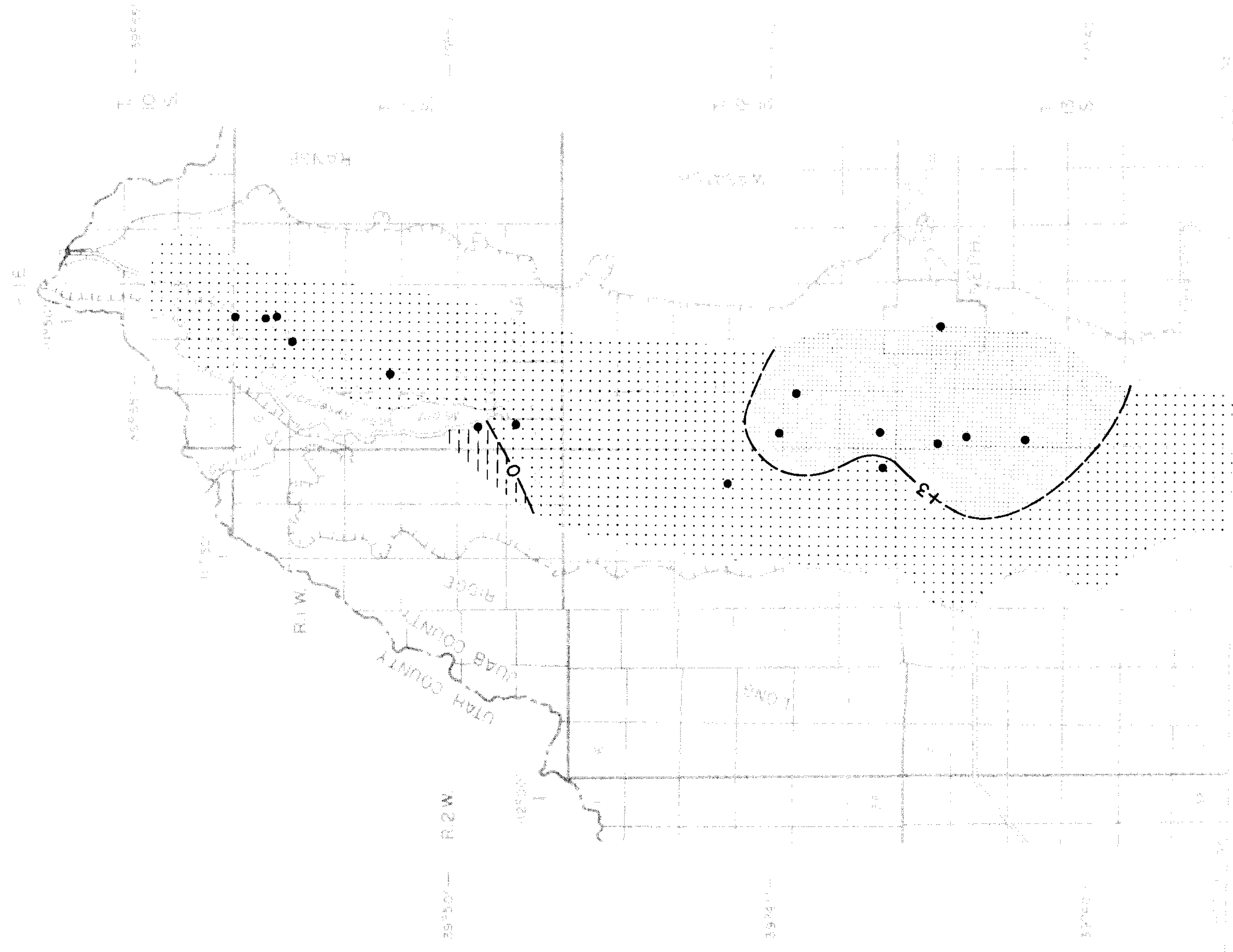


Figure 15.—Relation of water levels in selected wells in Utah Valley to cumulative departure from the average annual precipitation at Alpine and Payson.


+3
0
R 1 W
R 2 W
UTAH COUNTY
JUAB COUNTY

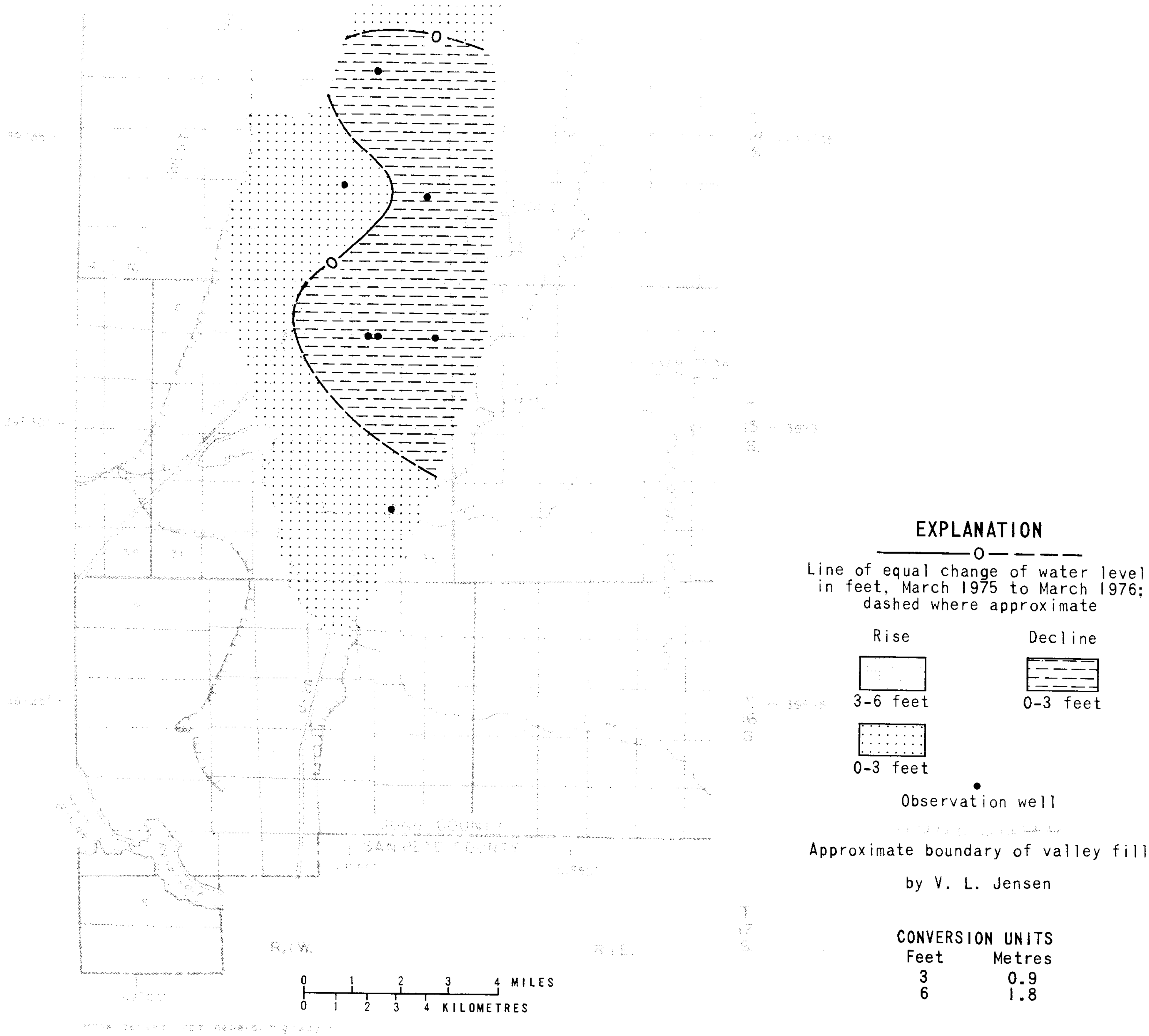


Figure 16.—Map of Juab Valley showing change of water levels from March 1975 to March 1976.

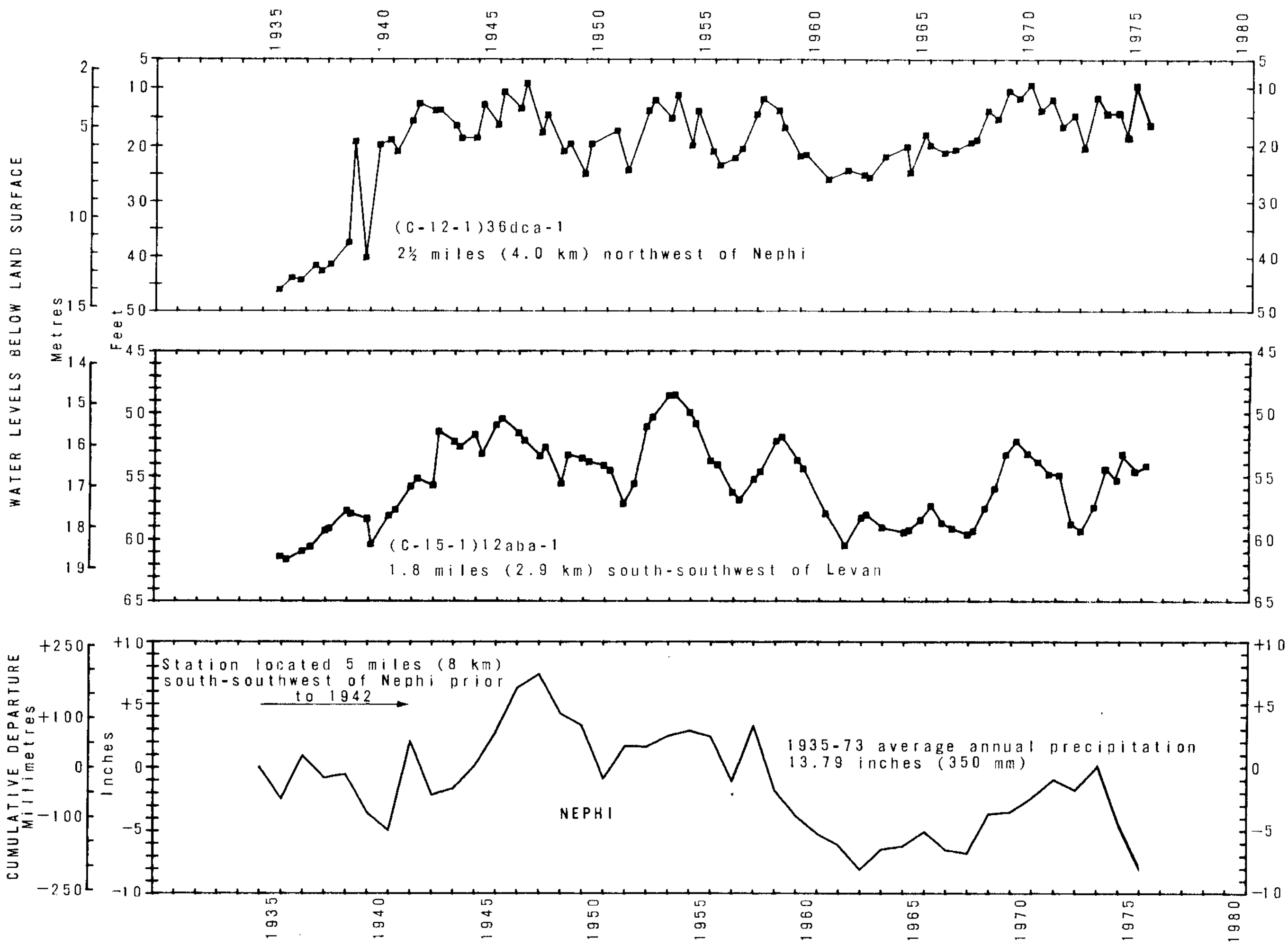


Figure 17.—Relation of water levels in selected wells in Juab Valley to cumulative departure from the average annual precipitation at Nephi.

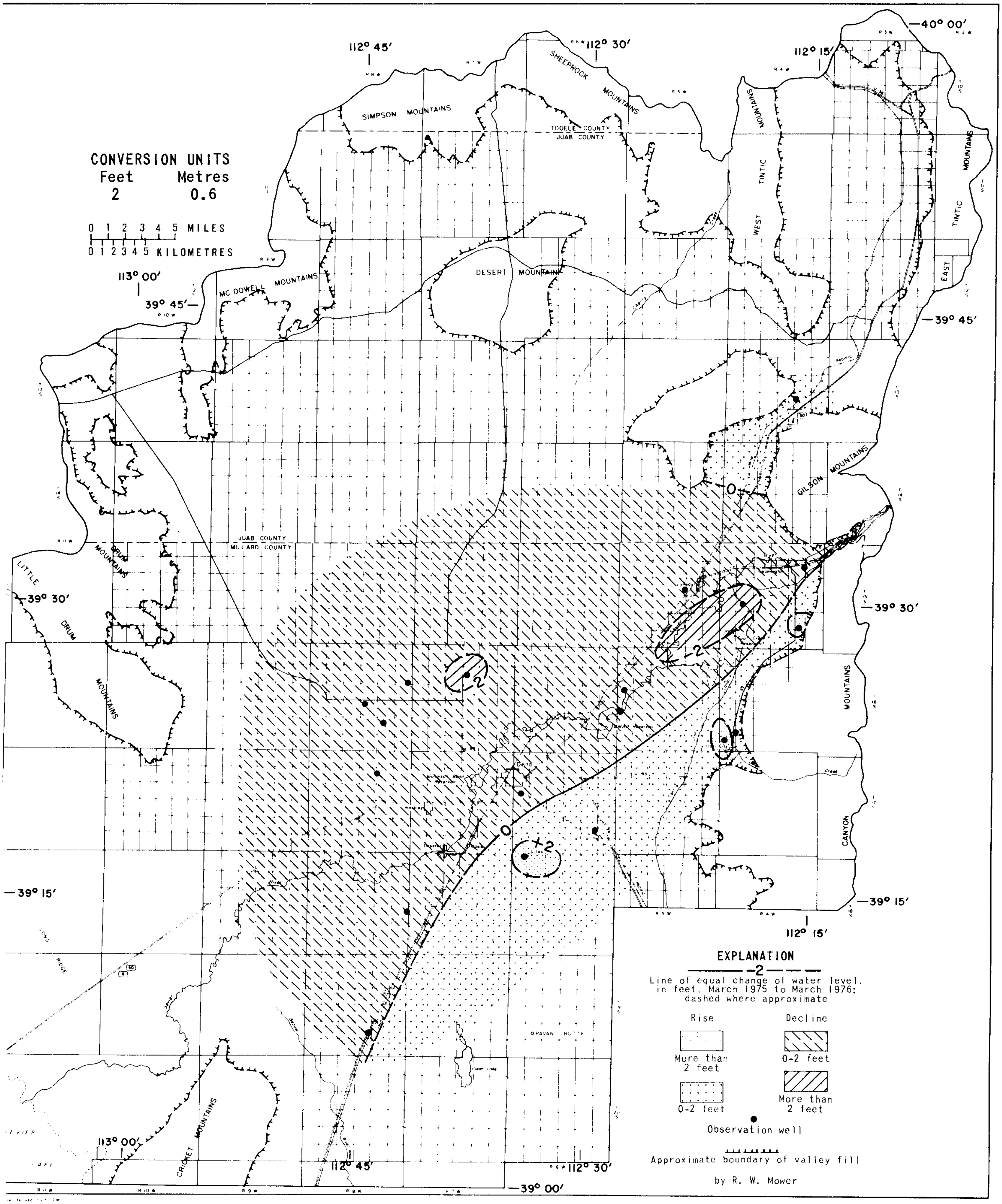


Figure 18.—Map of part of the Sevier Desert showing change of water levels in the lower artesian aquifer from March 1975 to March 1976.

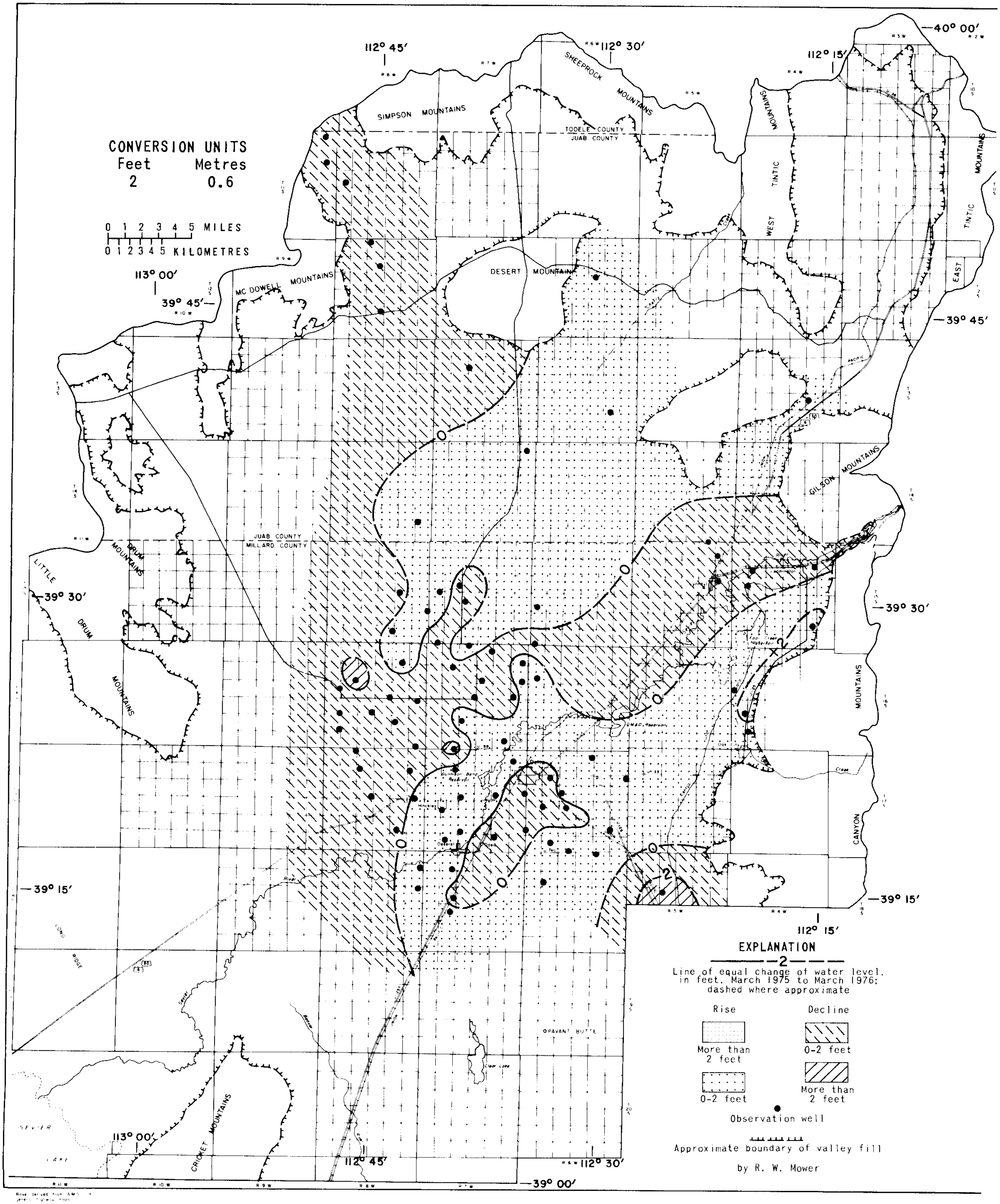


Figure 19.—Map of part of the Sevier Desert showing change of water levels in the upper artesian aquifer from March 1975 to March 1976.

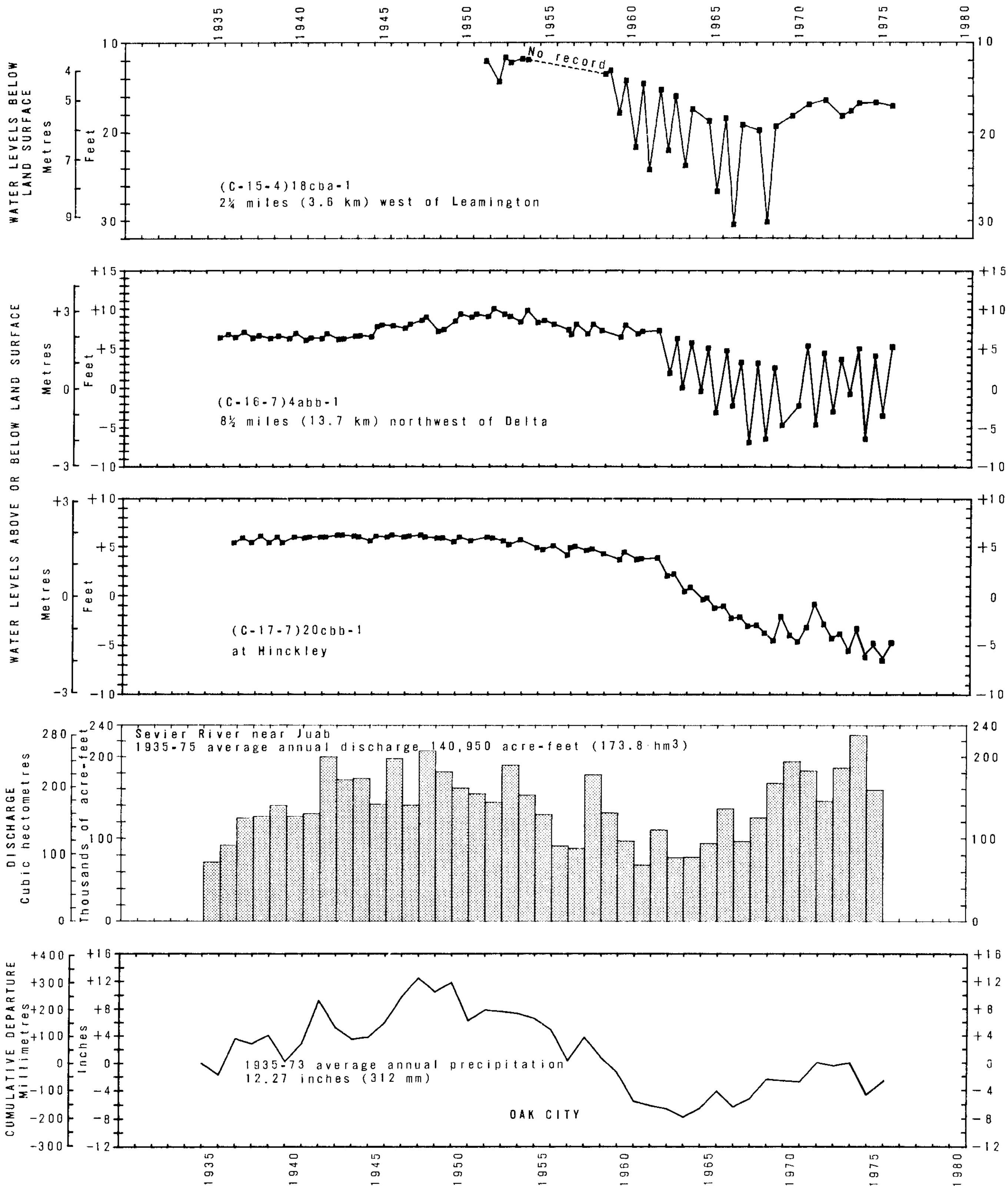


Figure 20.—Relation of water levels in selected wells in the Sevier Desert to discharge of the Sevier River near Juab and to cumulative departure from the average annual precipitation at Oak City.

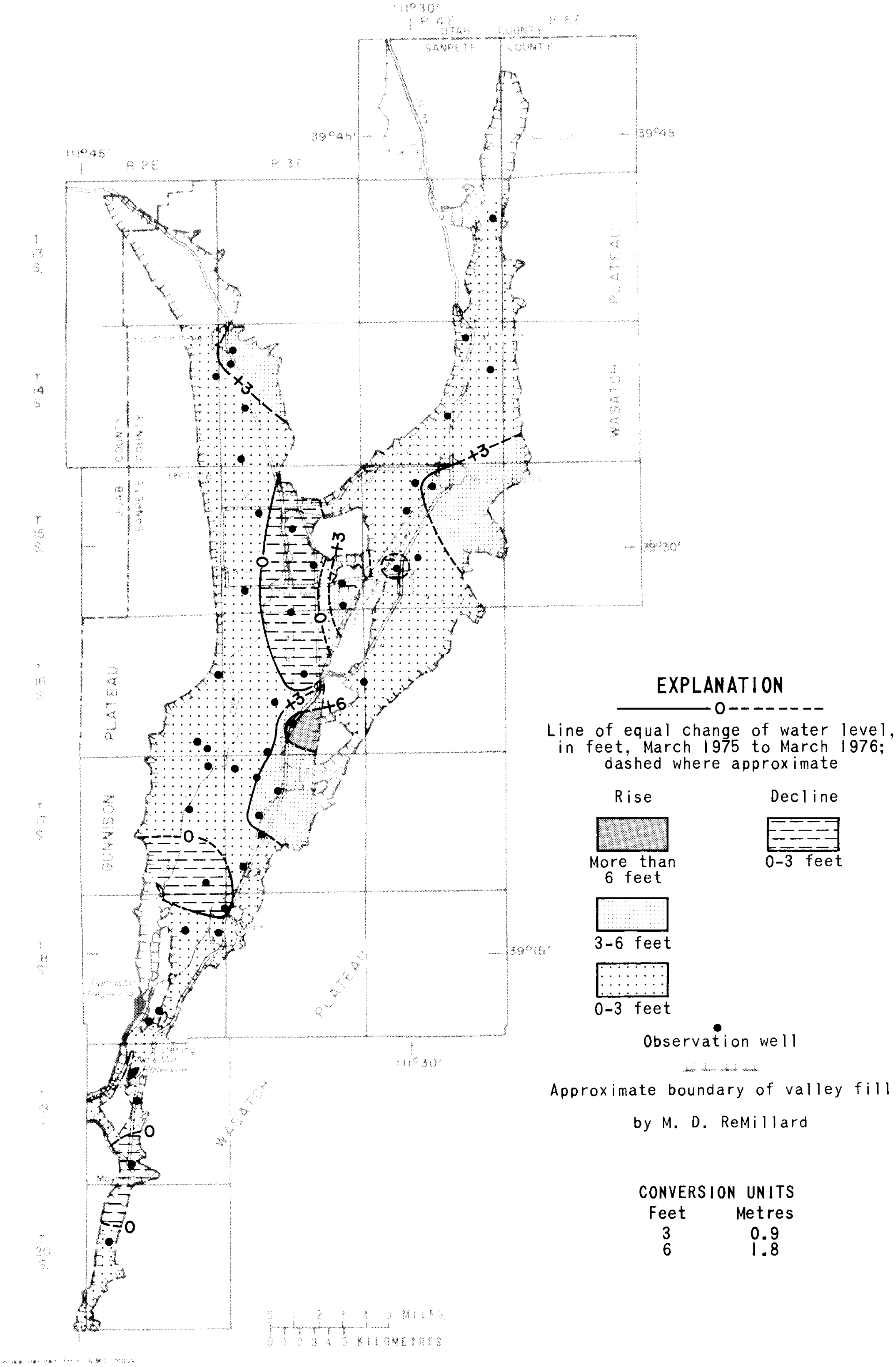


Figure 21.—Map of Sanpete Valley showing change of water levels from March 1975 to March 1976.

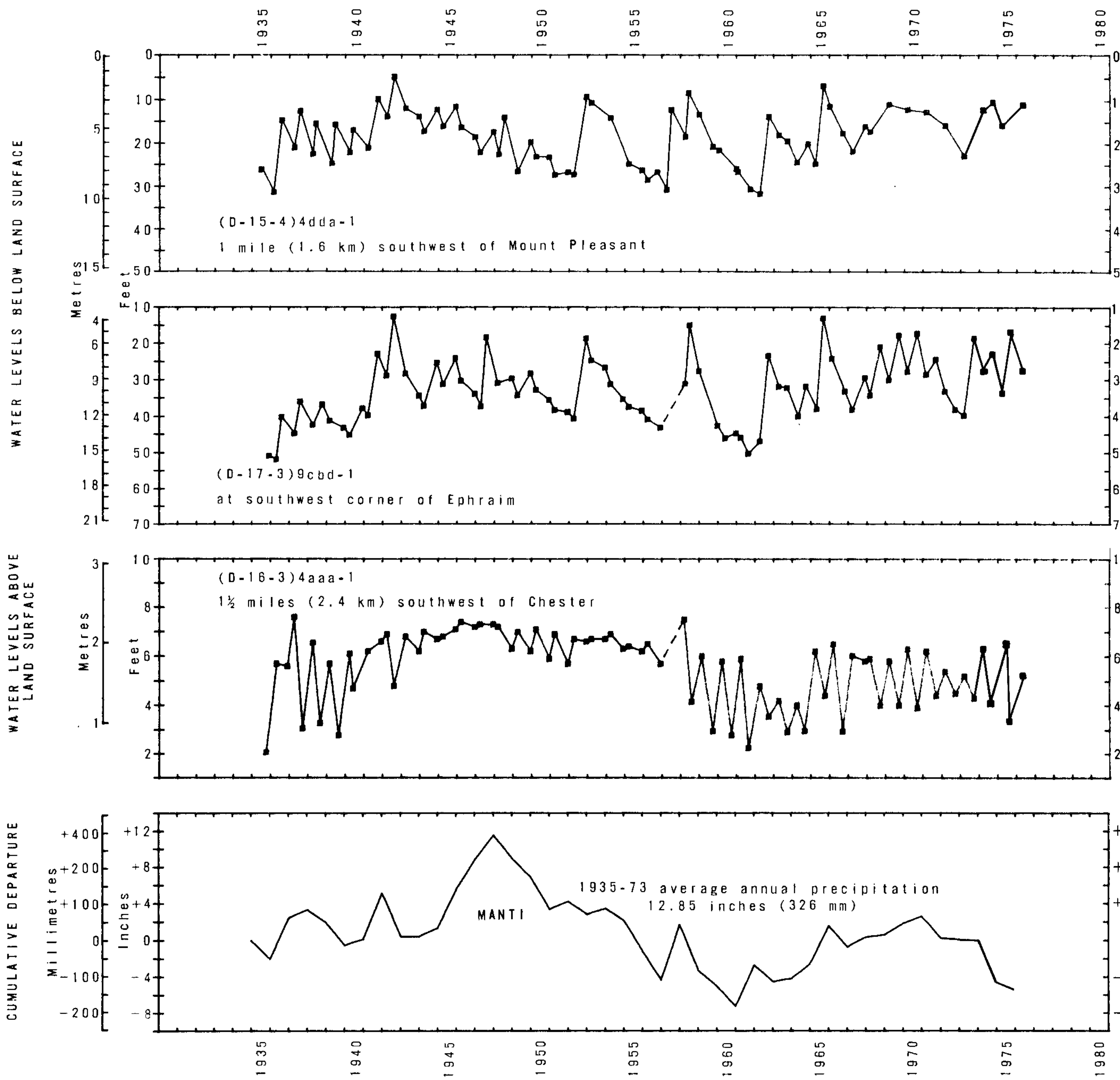
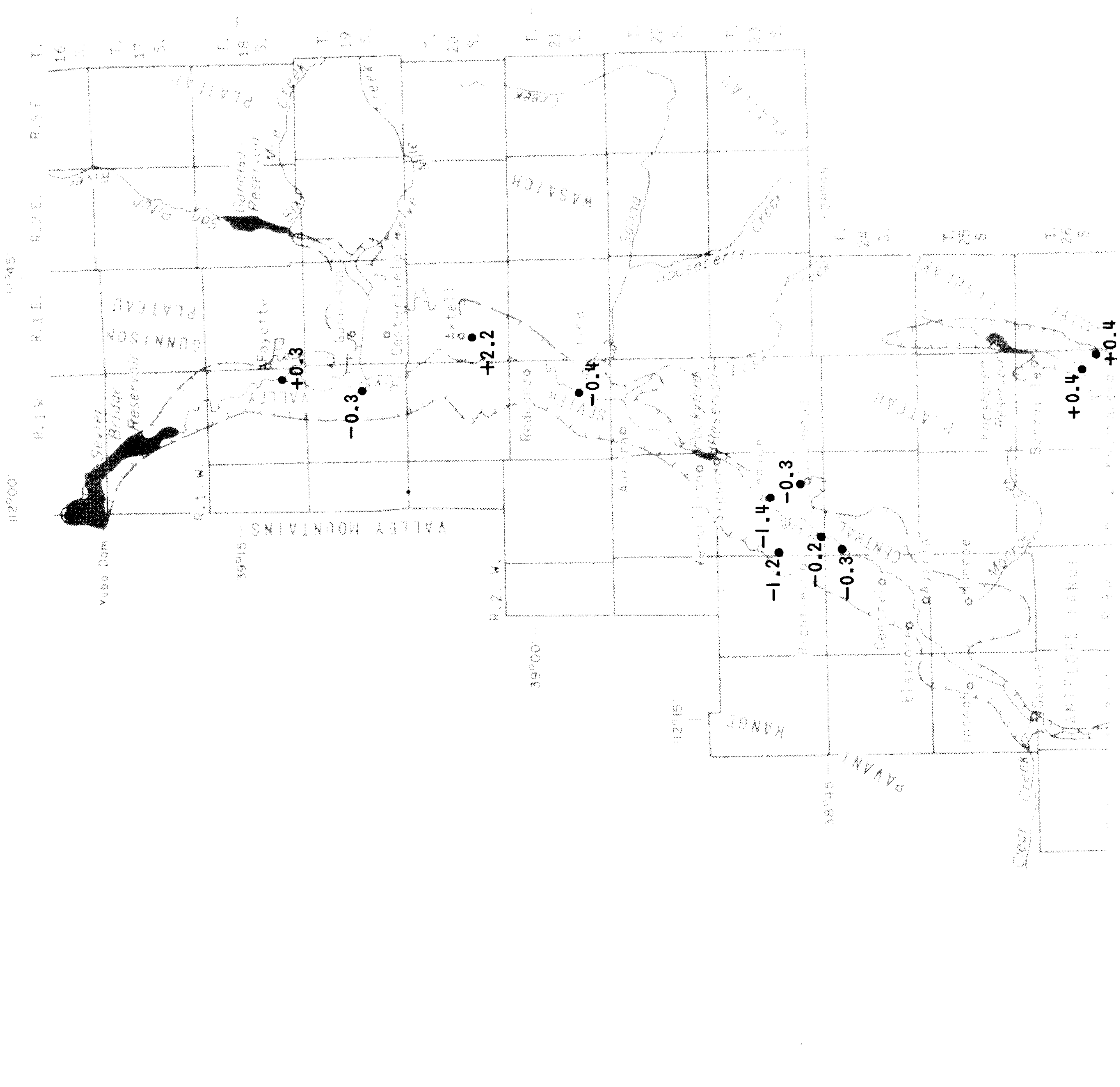


Figure 22.—Relation of water levels in selected wells in Sanpete Valley to cumulative departure from the average annual precipitation at Manti.


+0.3
-0.3
+2.2
-0.4
-1.4
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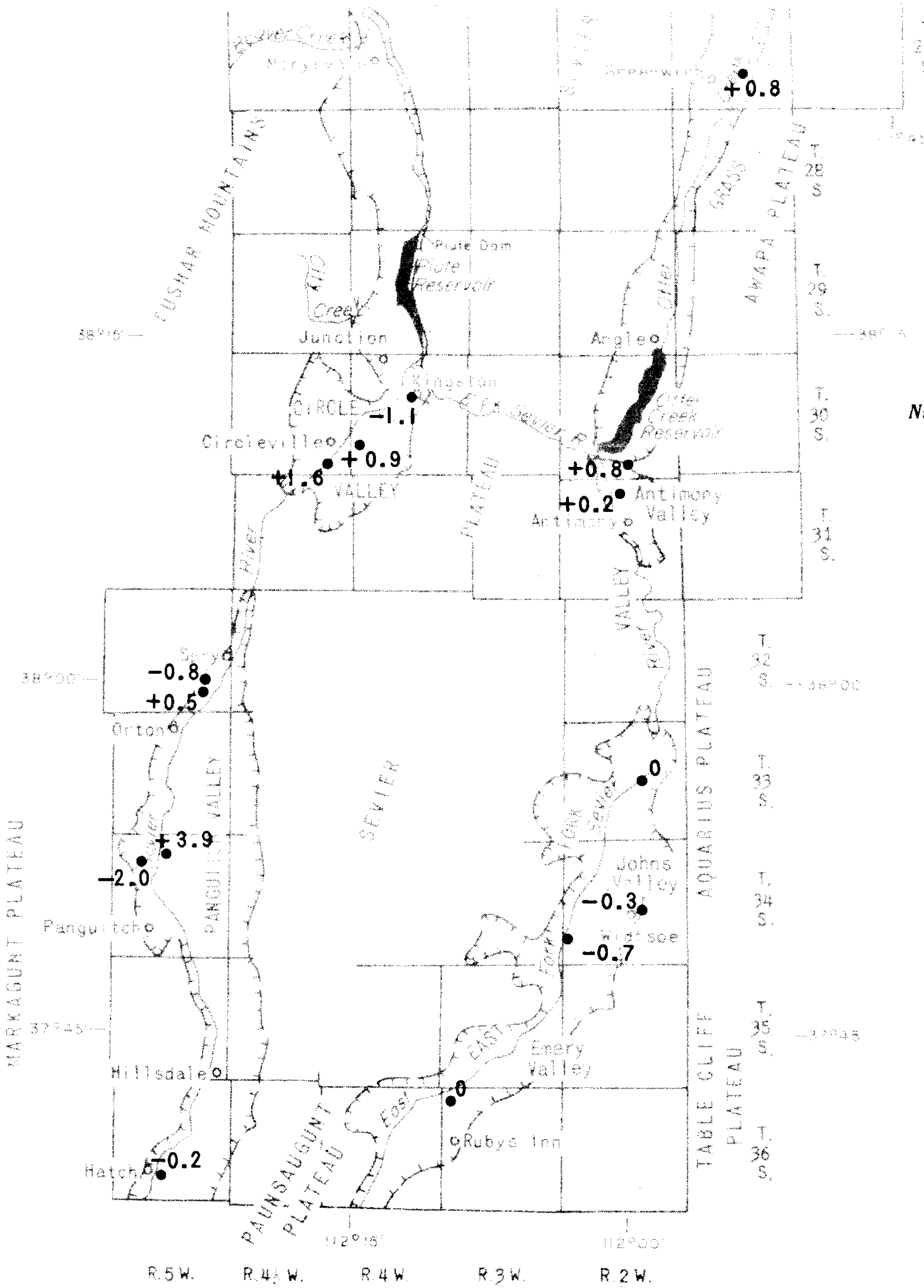
-1.2
-0.2
-0.3
+0.4
+0.4
VALLEY MOUNTAINS
WASATCH
GUNNISON PLATEAU



EXPLANATION

$\bullet^{-1.2}$

Observation well

Number indicates change of water level, in feet, March 1975 to March 1976

Approximate boundary of valley fill

by G. W. Sandberg

CONVERSION UNITS

Feet	Metres
1	0.3
2	0.6
3	0.9
4	1.2

0 5 10 MILES

0 5 10 KILOMETRES

Figure 23.--Map of the upper and central Sevier Valleys showing change of water levels from March 1975 to March 1976.

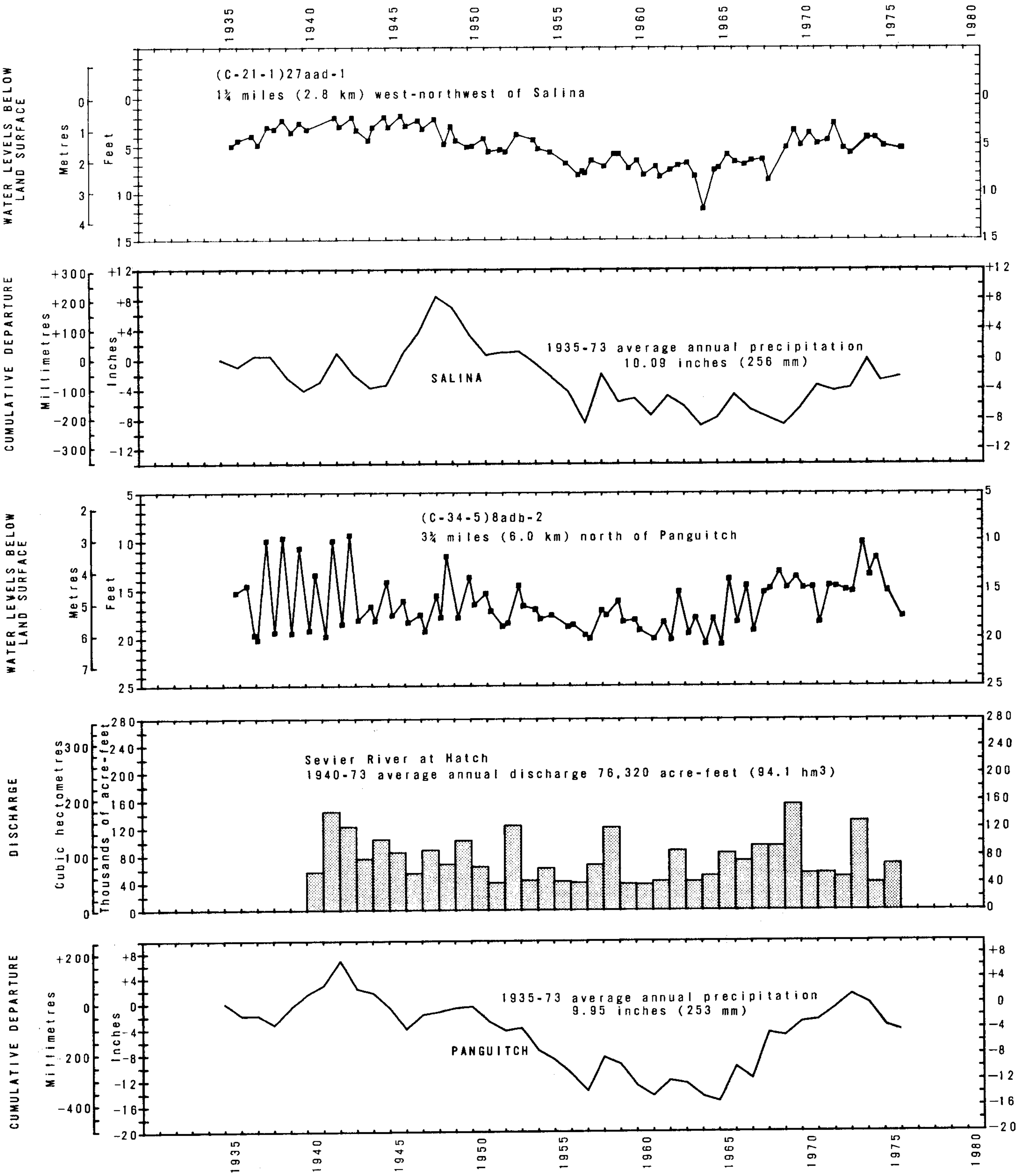


Figure 24.—Relation of water levels in selected wells in the upper and central Sevier Valleys to discharge of the Sevier River at Hatch and to cumulative departure from the average annual precipitation at Salina and Panguitch.

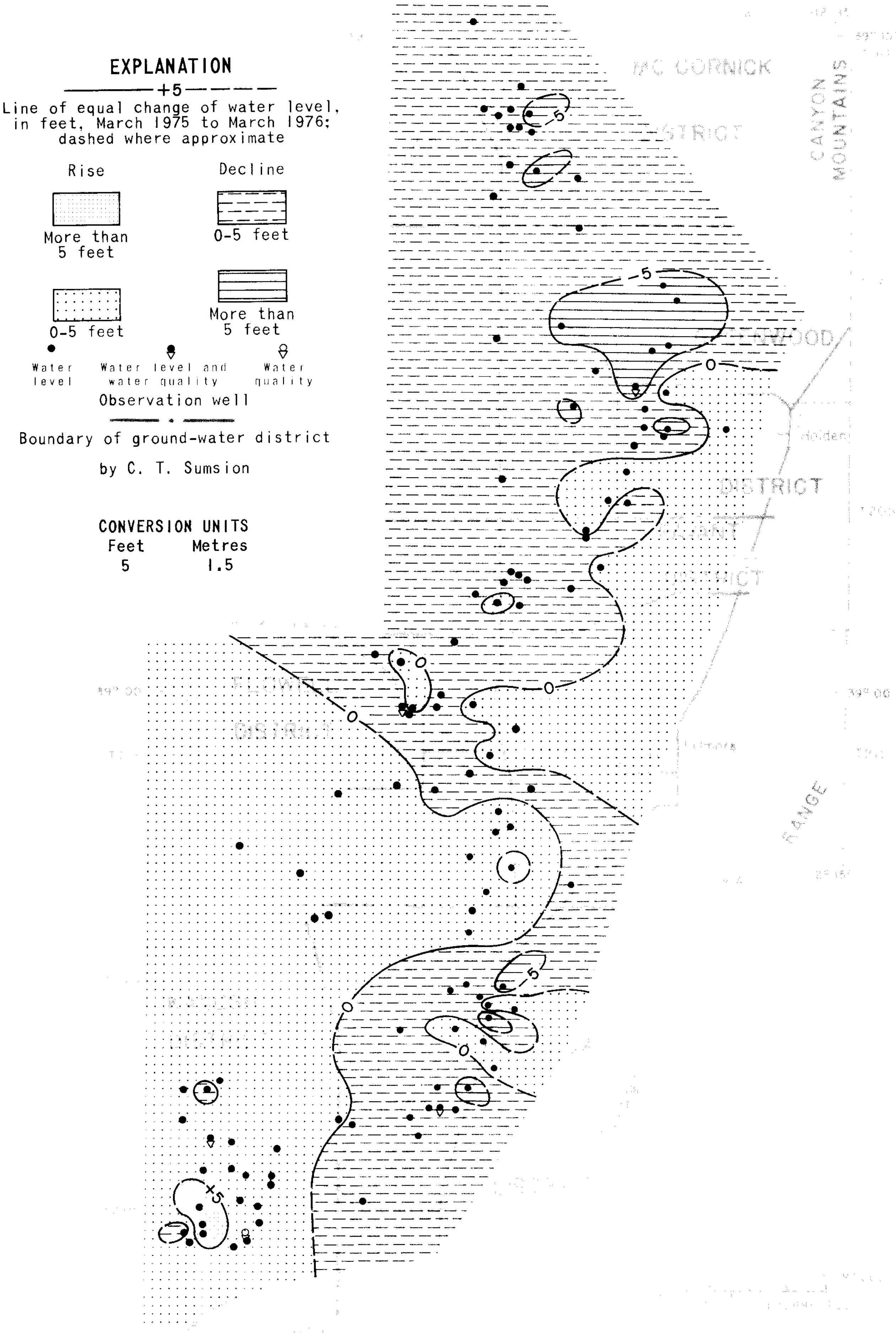


Figure 25.—Map of Pavant Valley showing change of water levels from March 1975 to March 1976.

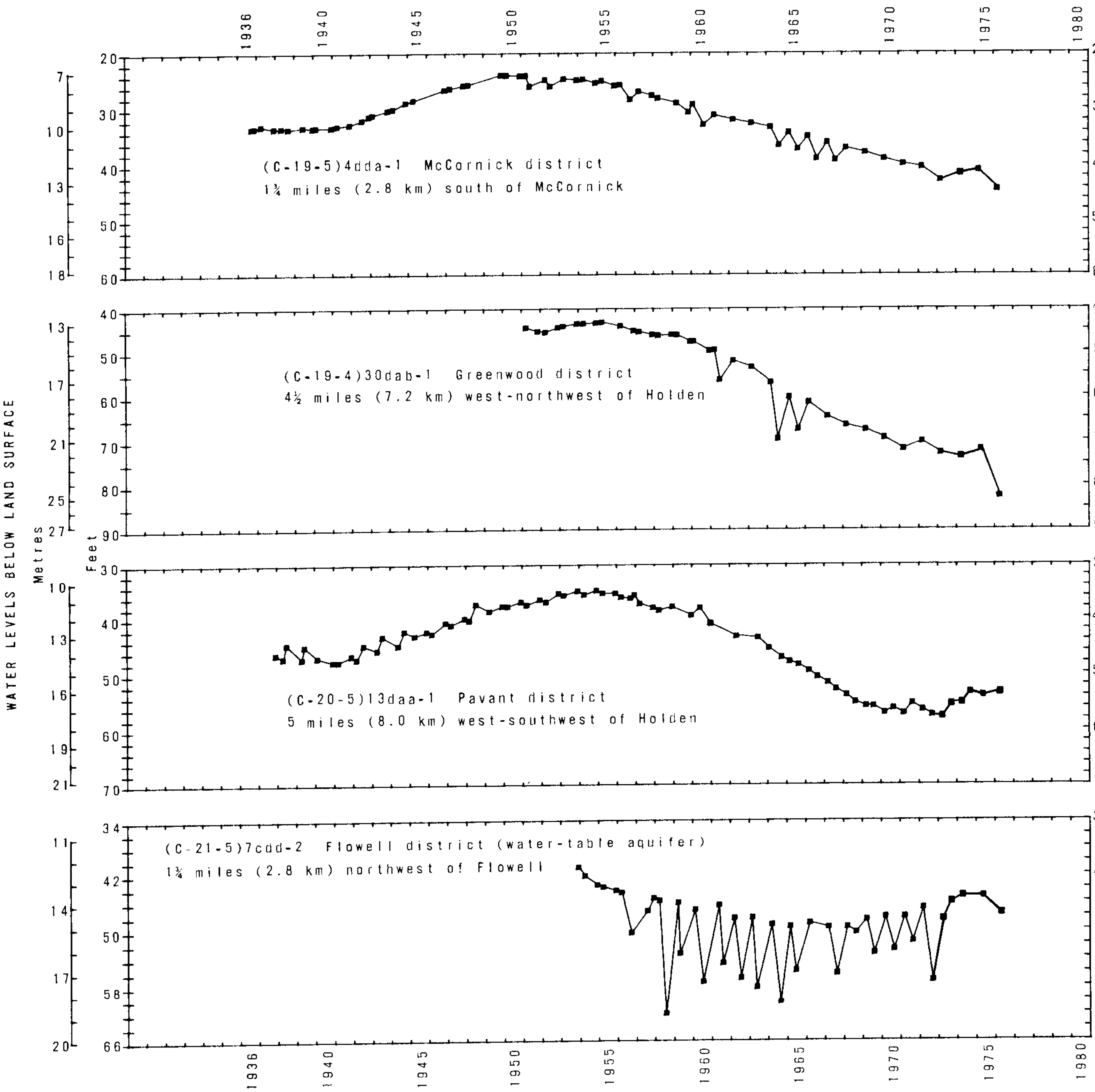


Figure 26.—Relation of water levels in selected wells in Pavant Valley to cumulative departure from the average annual precipitation at Fillmore and to total withdrawals from wells.

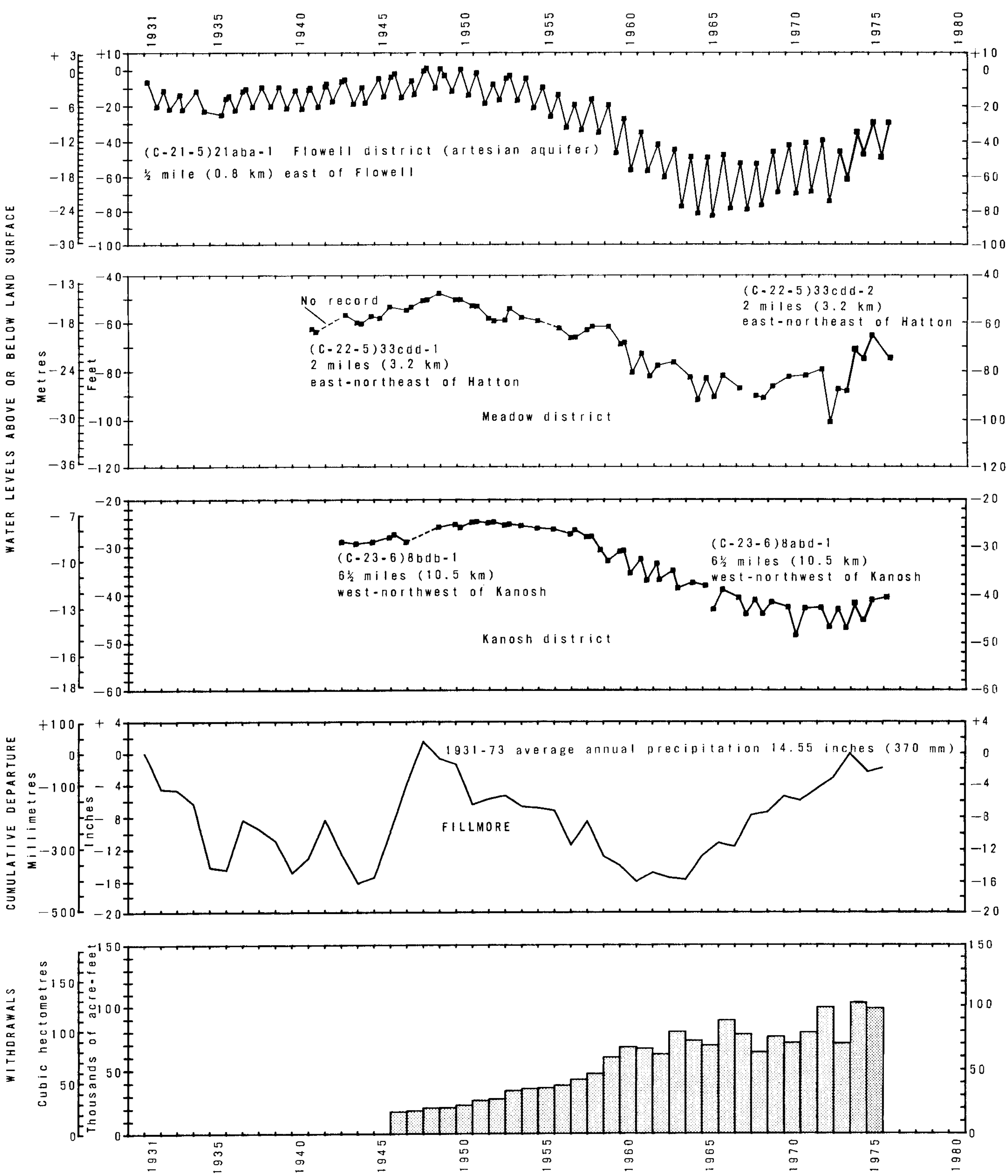


Figure 26.—Continued.

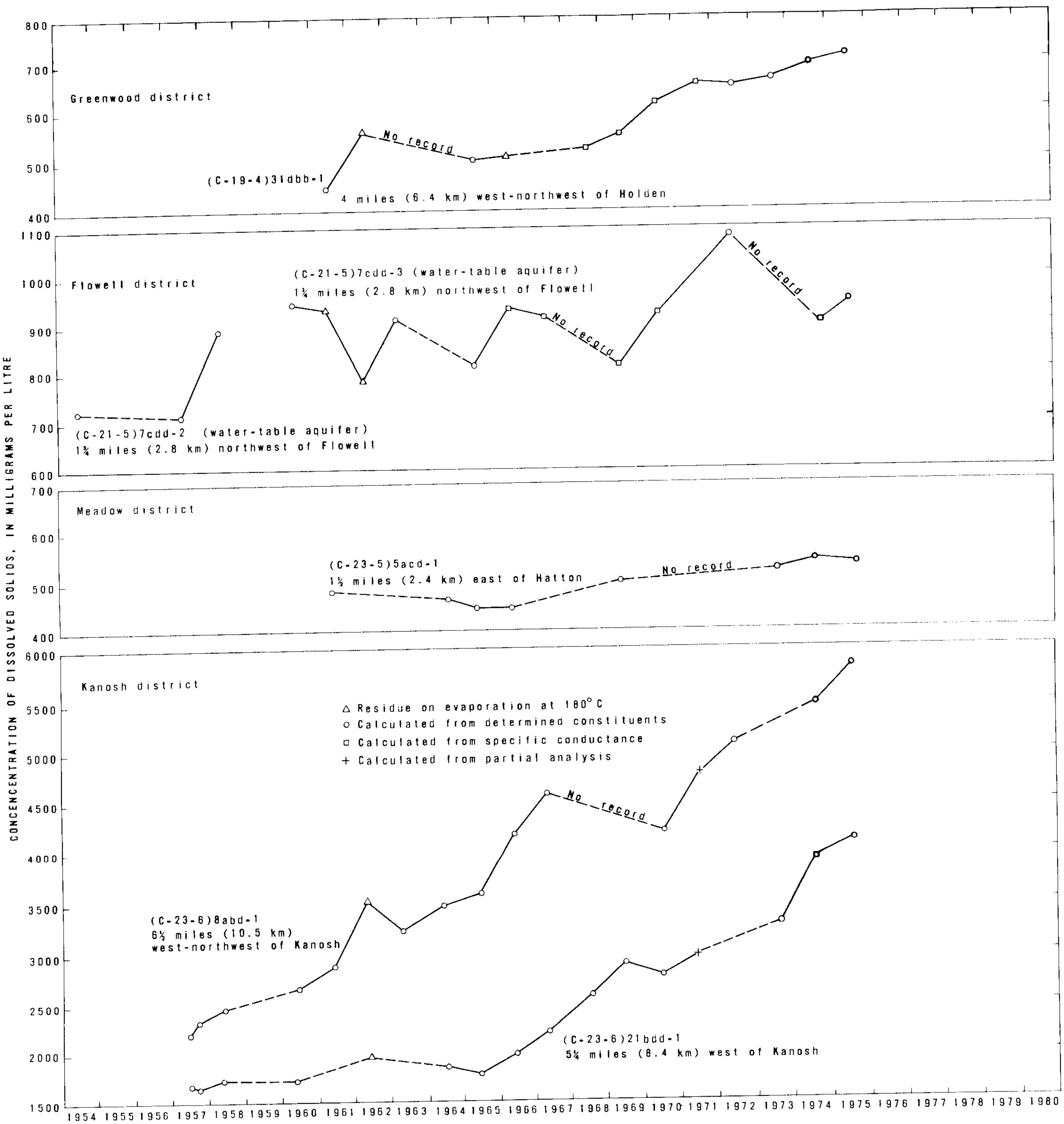


Figure 27.—Concentration of dissolved solids in water from selected wells in Pavant Valley.

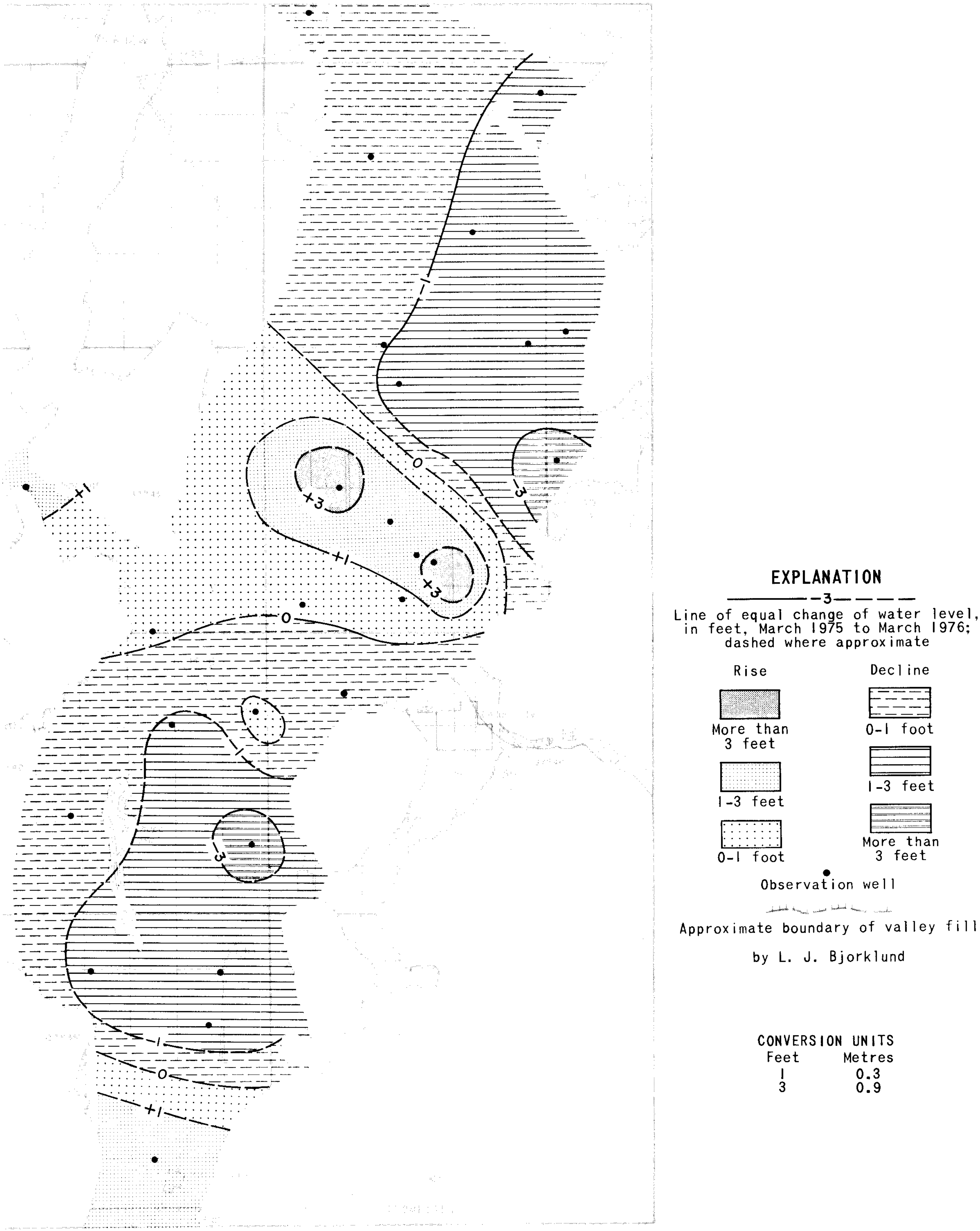


Figure 28.—Map of Cedar City Valley showing change of water levels from March 1975 to March 1976.

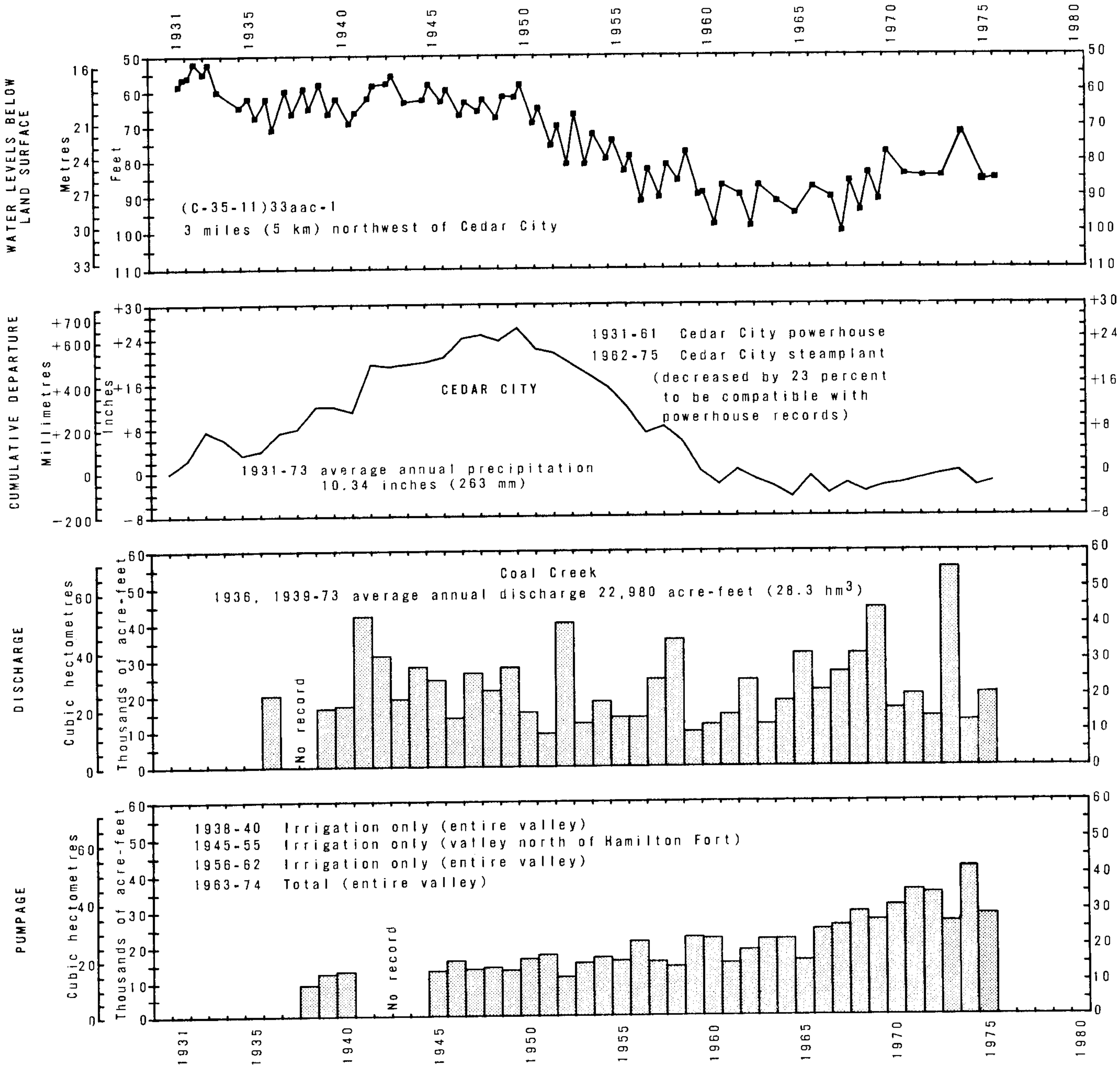


Figure 29.—Relation of water levels in well (C-35-11)33aac-1 in Cedar City Valley to cumulative departure from the average annual precipitation at the Cedar City powerhouse, to discharge of Coal Creek near Cedar City, and to pumpage from wells.

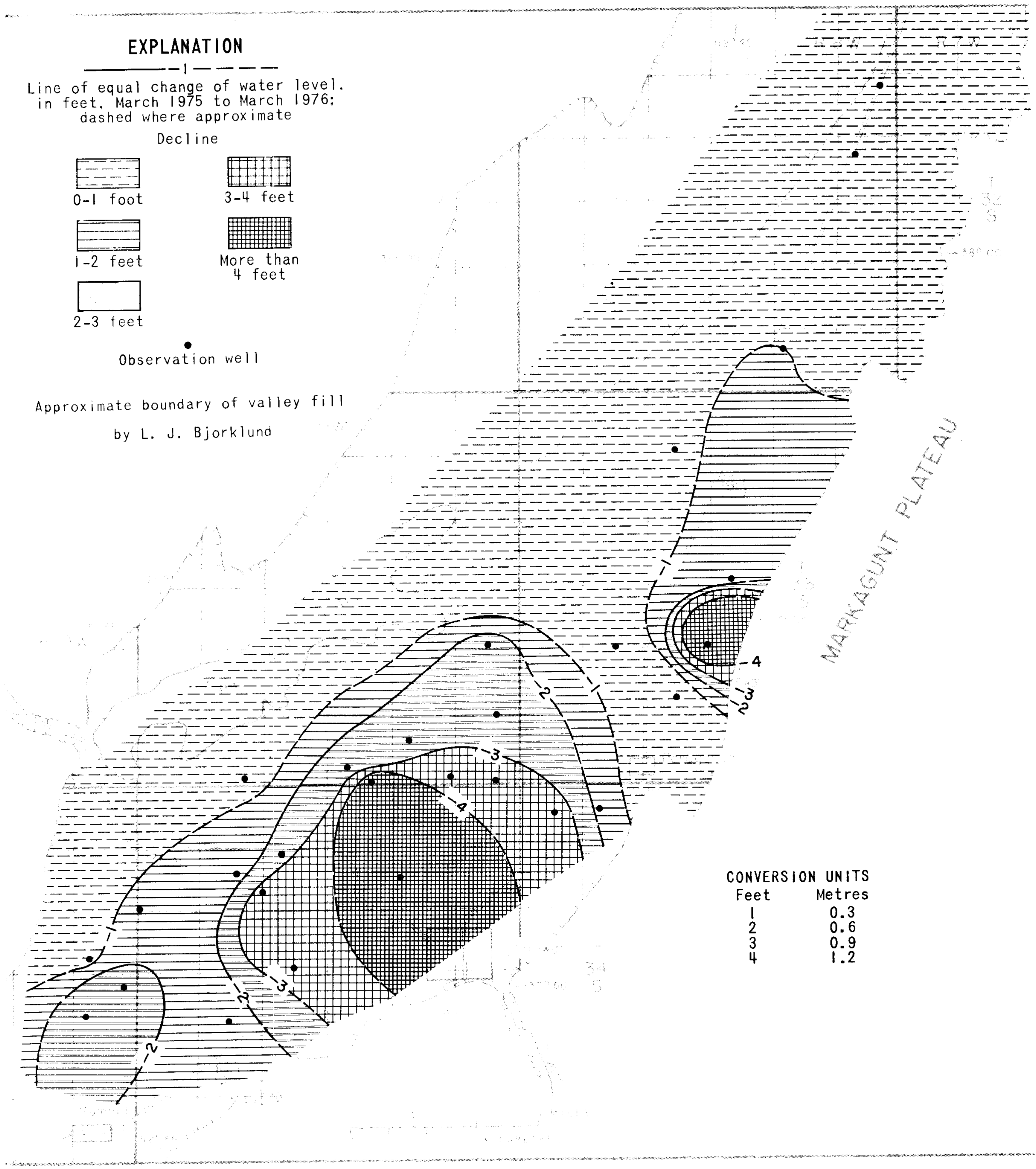


Figure 30.—Map of Parowan Valley showing change of water levels from March 1975 to March 1976.

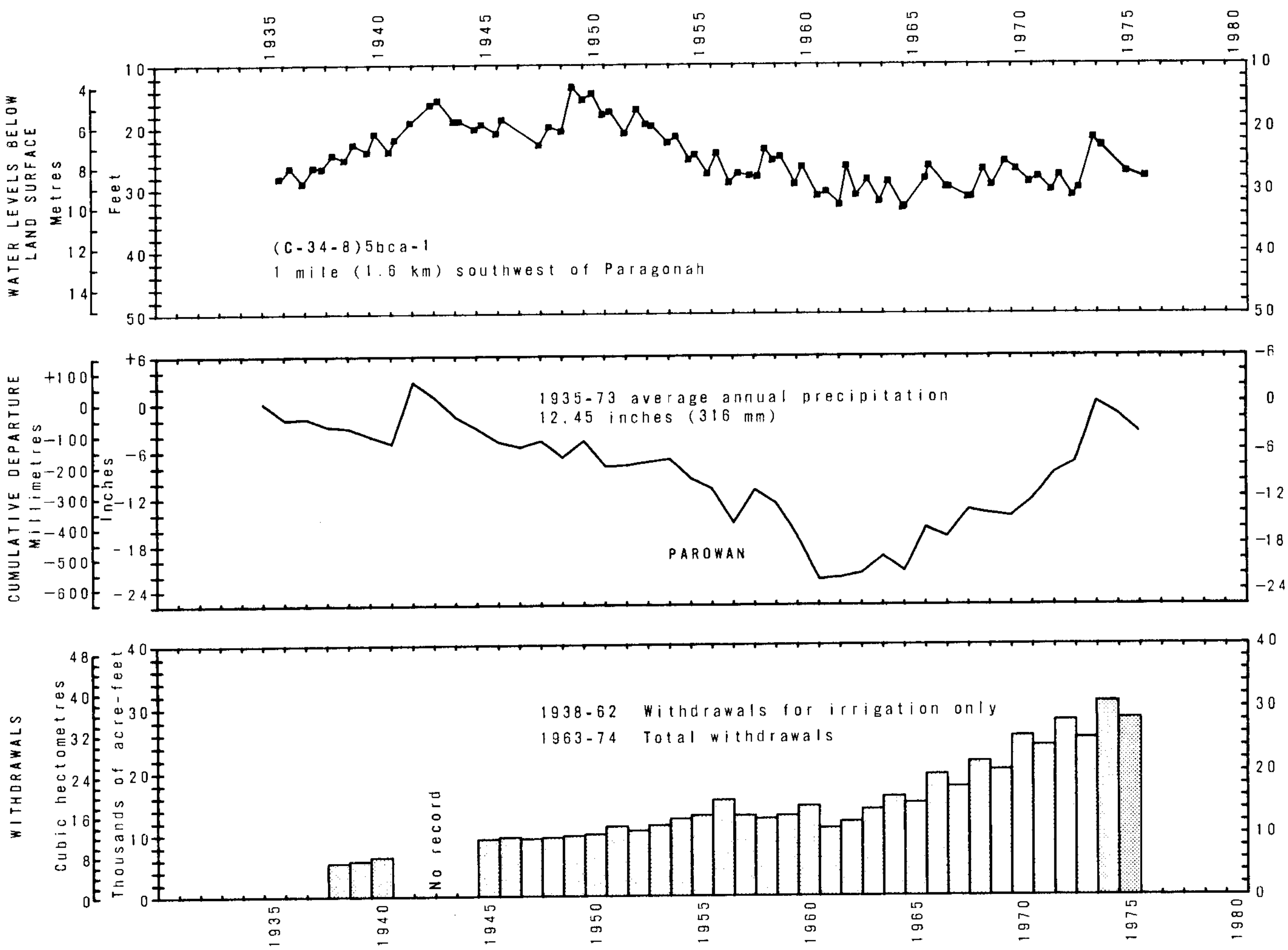


Figure 31.— Relation of water levels in well (C-34-8)5bca-1 in Parowan Valley to cumulative departure from the average annual precipitation at Parowan and to withdrawals from wells.

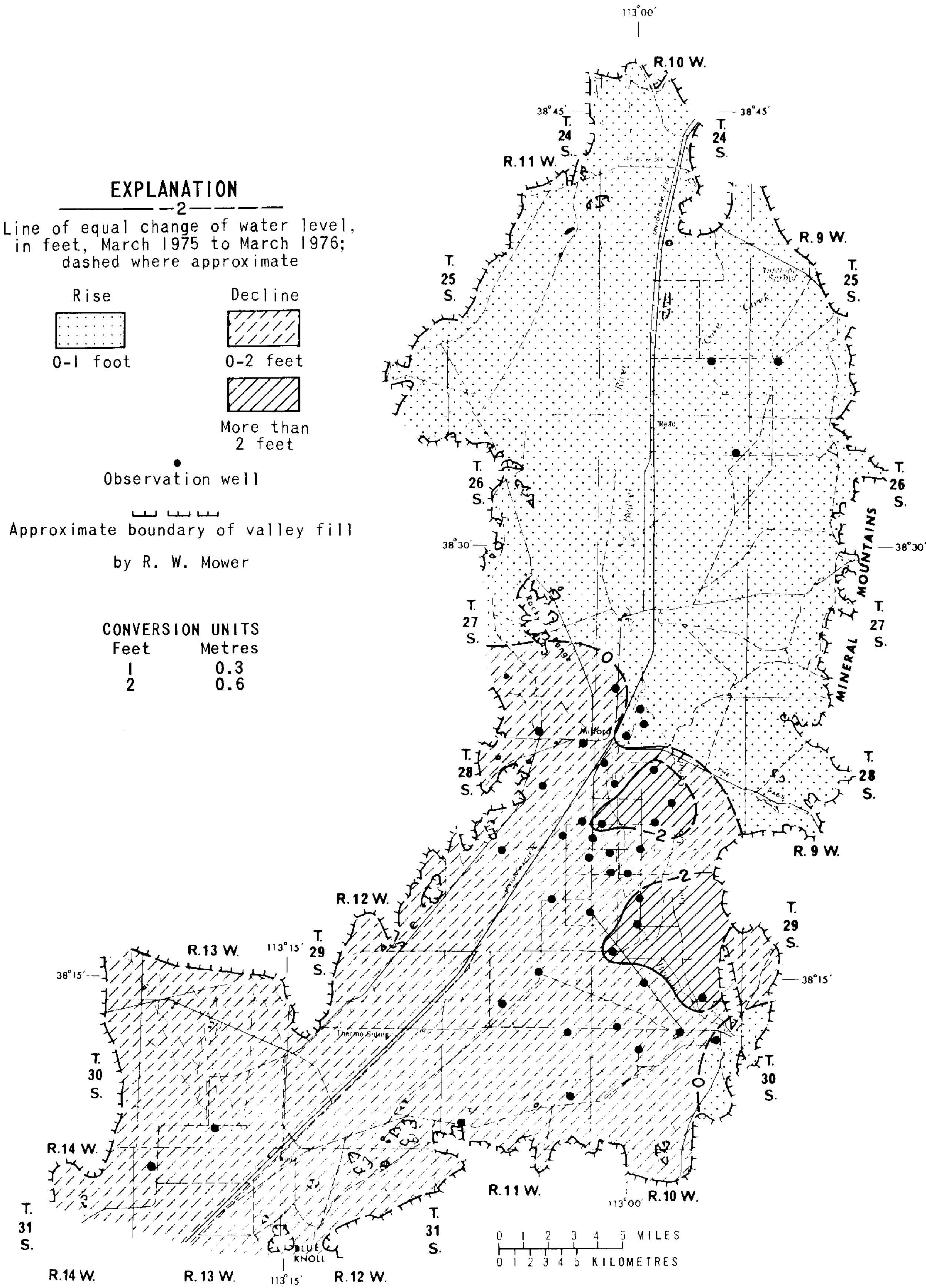


Figure 32.—Map of the Milford area, Escalante Valley, showing change of water levels from March 1975 to March 1976.

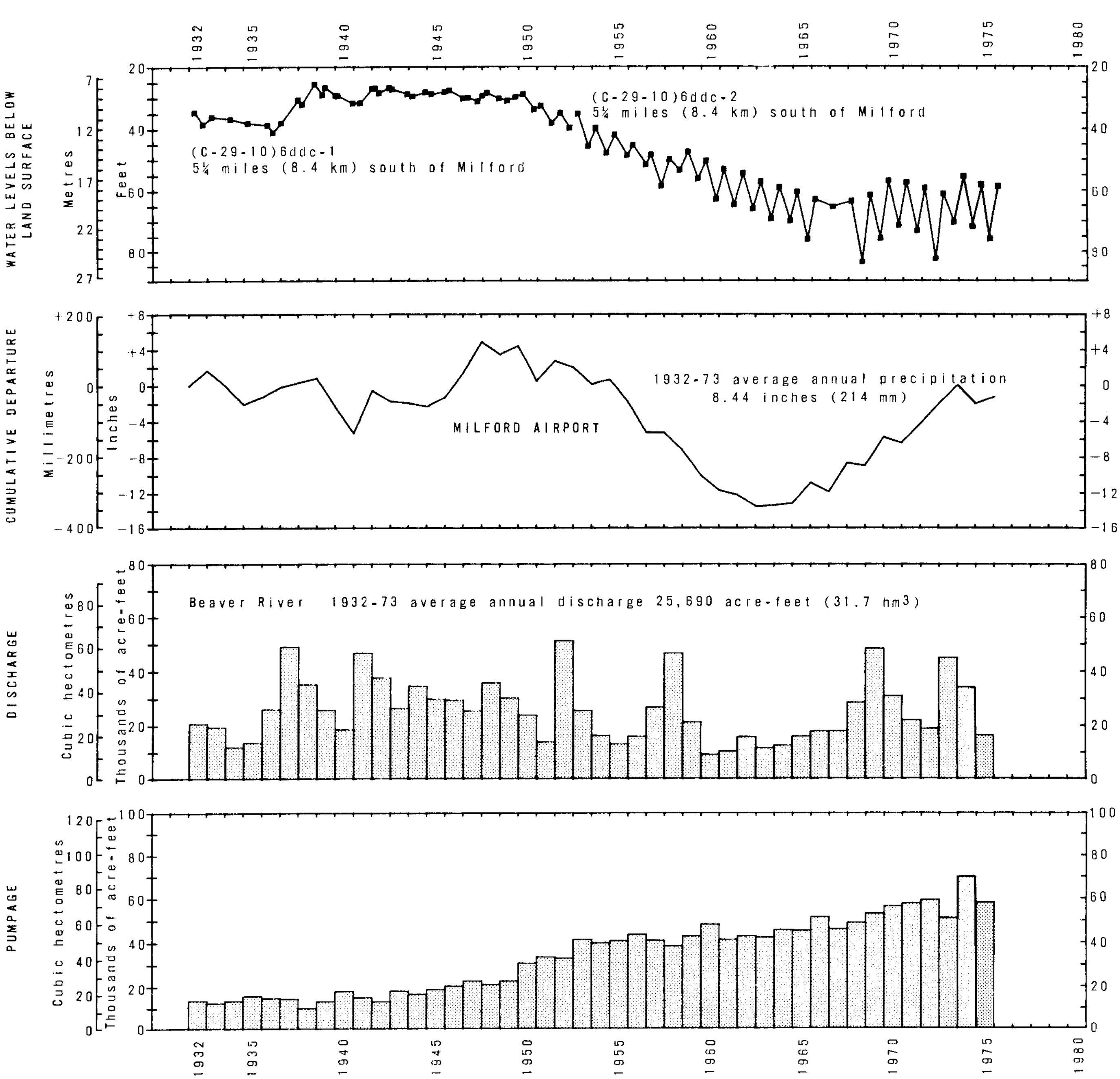


Figure 33.— Relation of water levels in selected wells in the Milford area, Escalante Valley, to cumulative departure from the average annual precipitation at Milford airport, to discharge of the Beaver River at Rockyford Dam near Minersville, and to pumpage for irrigation.

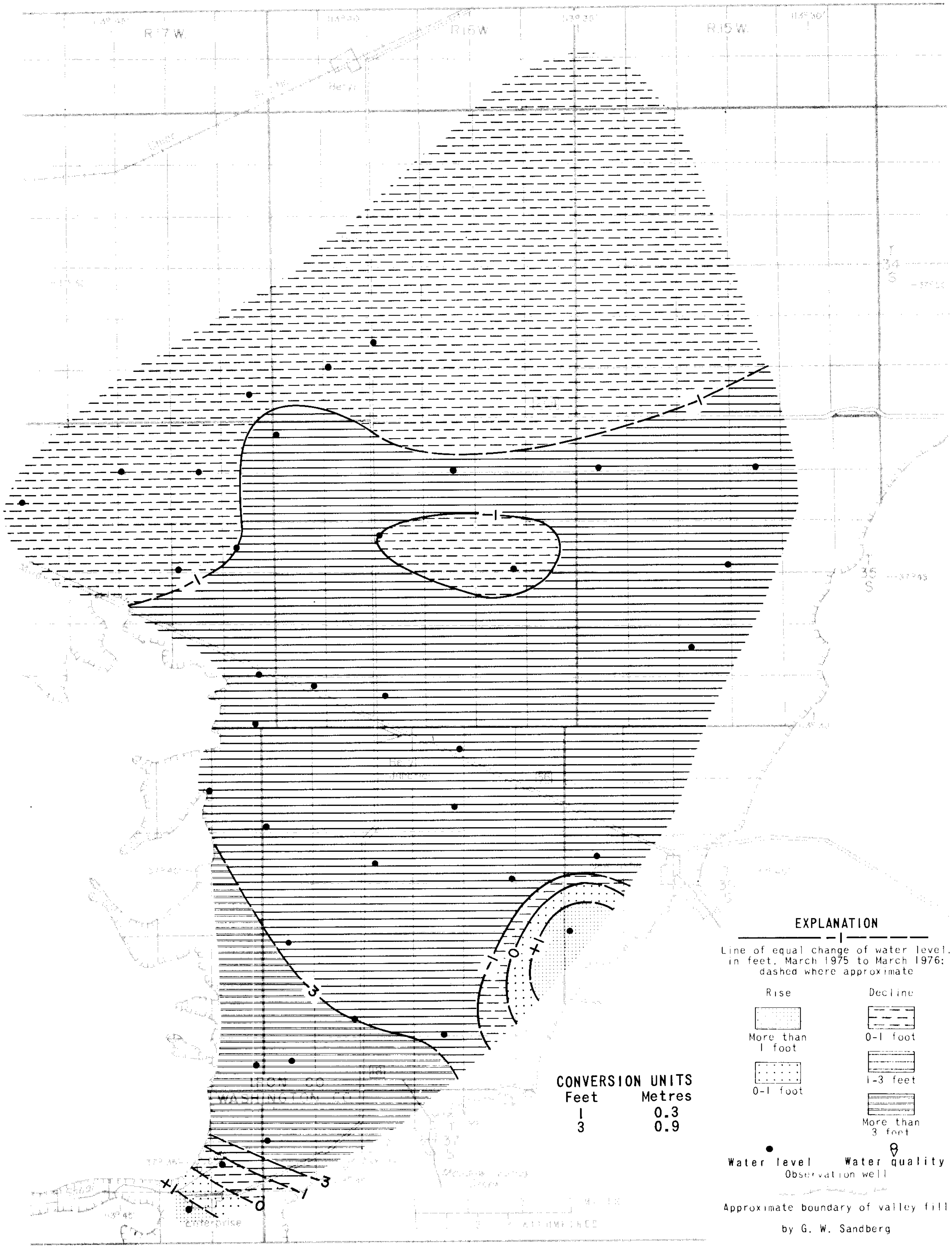


Figure 34.—Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1975 to March 1976.

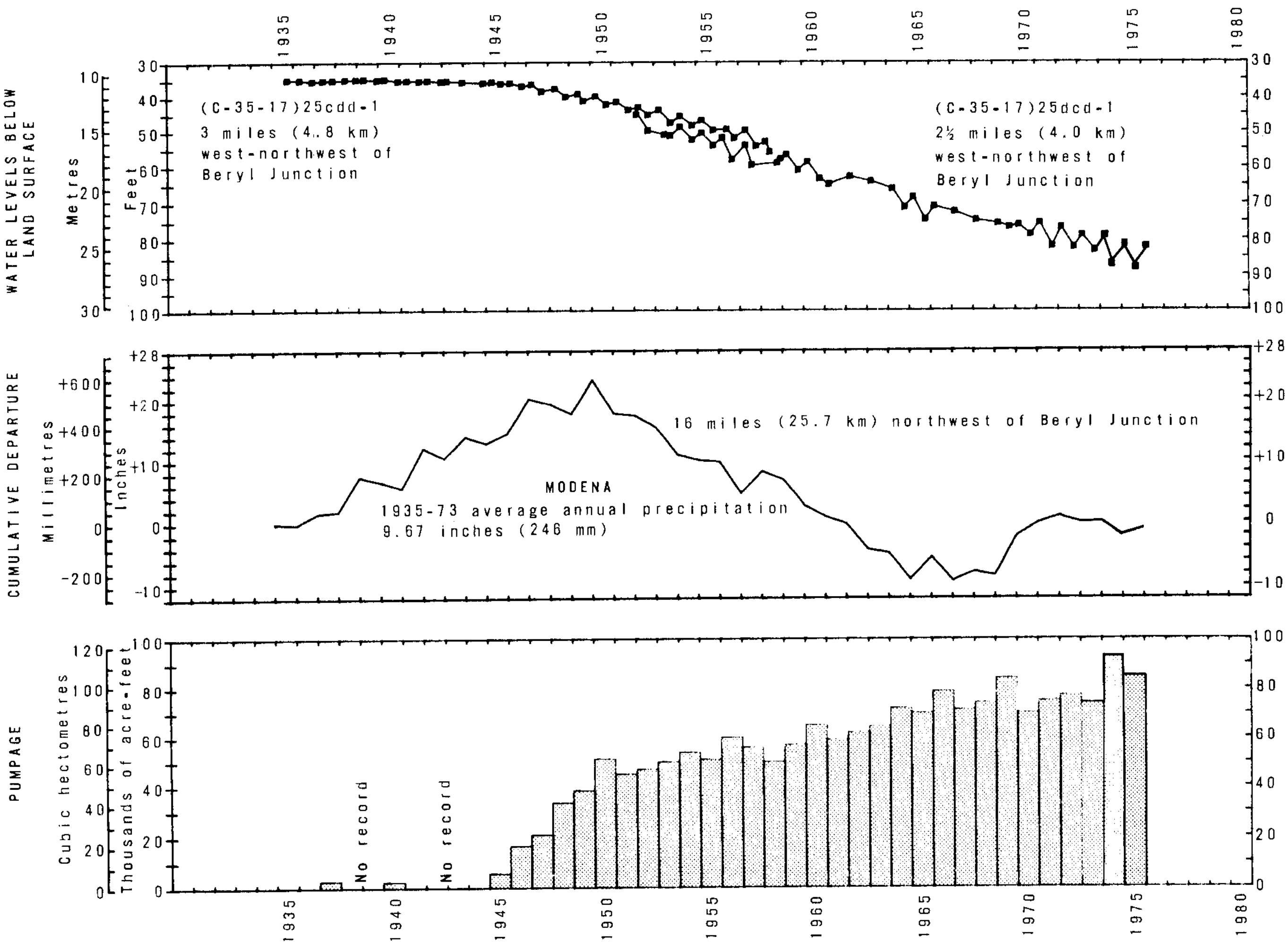


Figure 35.— Relation of water levels in selected wells in the Beryl-Enterprise area, Escalante Valley, to cumulative departure from the average annual precipitation at Modena and to pumpage for irrigation.

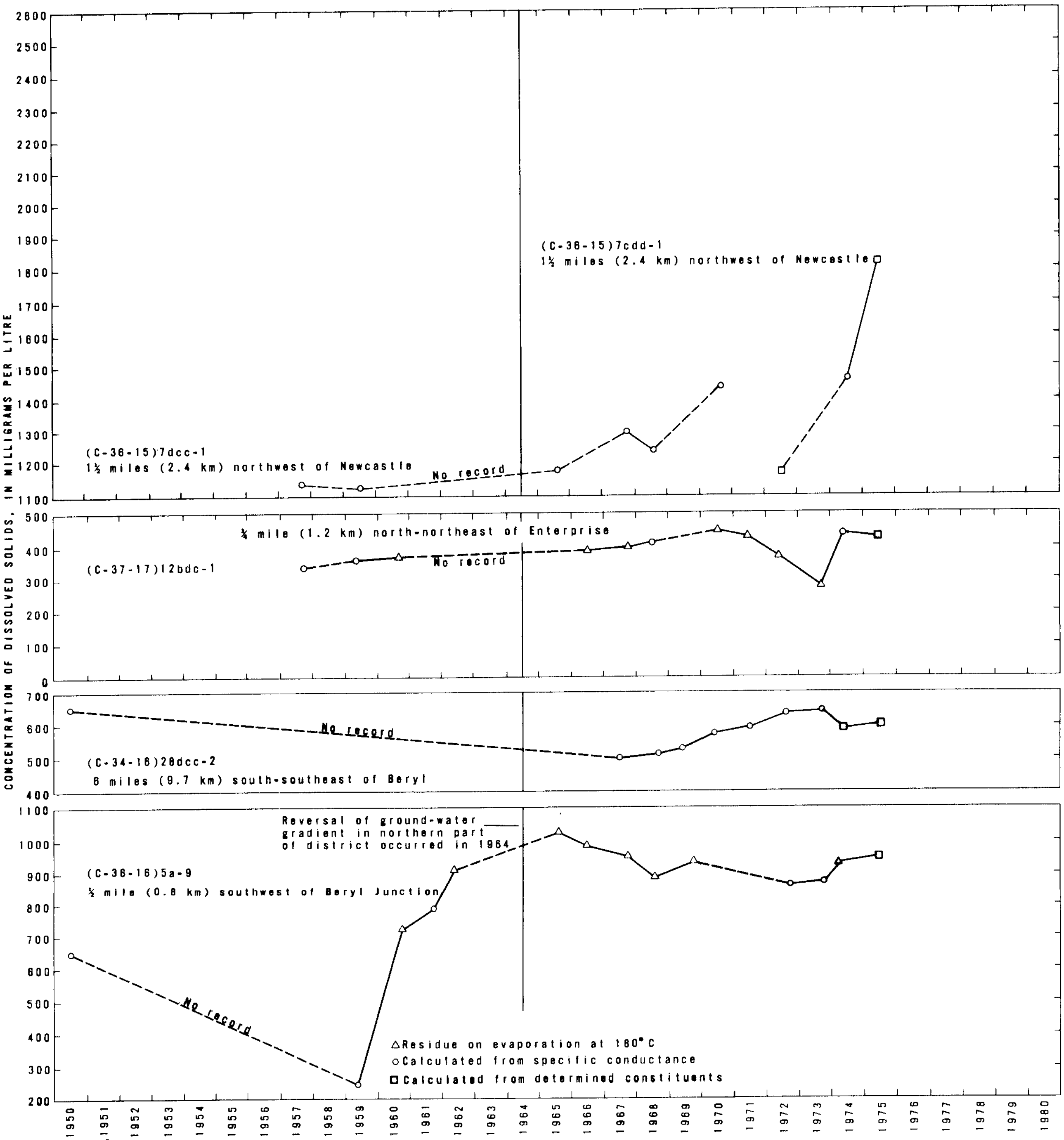


Figure 36.— Concentration of dissolved solids in water from selected wells in the Beryl-Enterprise area, Escalante Valley.

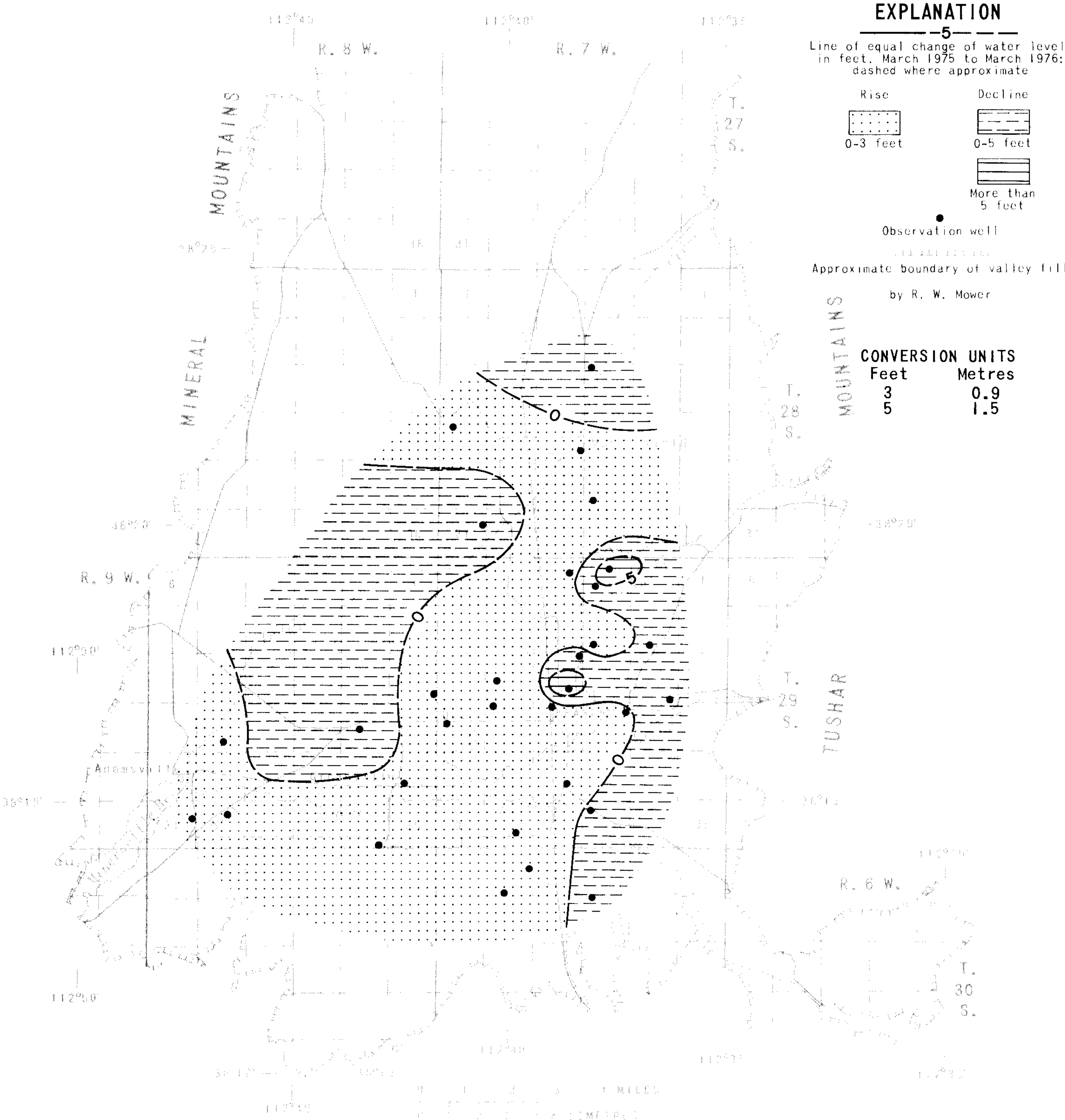


Figure 37.—Map of Beaver Valley showing change of water levels from March 1975 to March 1976.

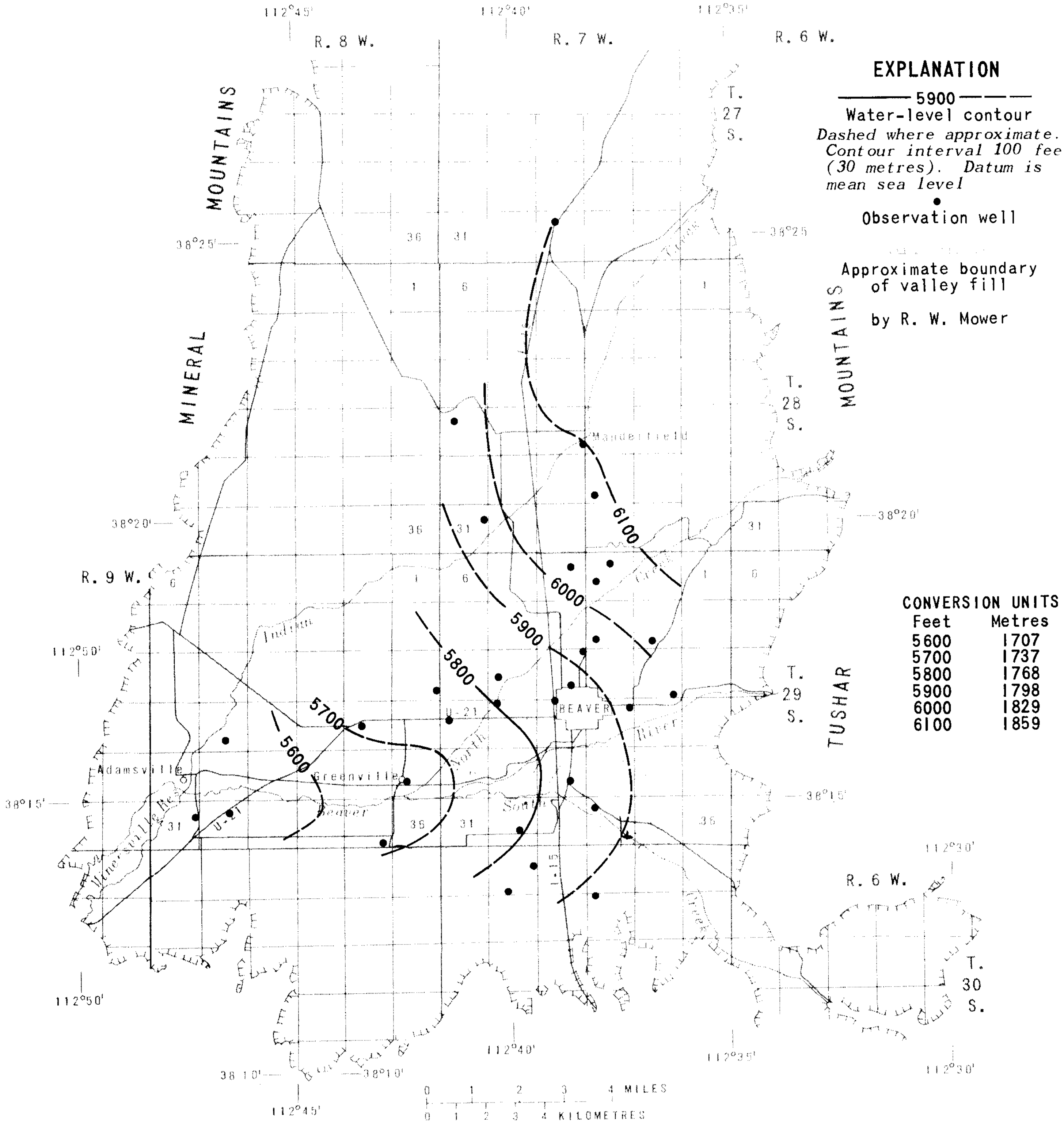


Figure 38.—Map of Beaver Valley showing water-level contours, March 1976.

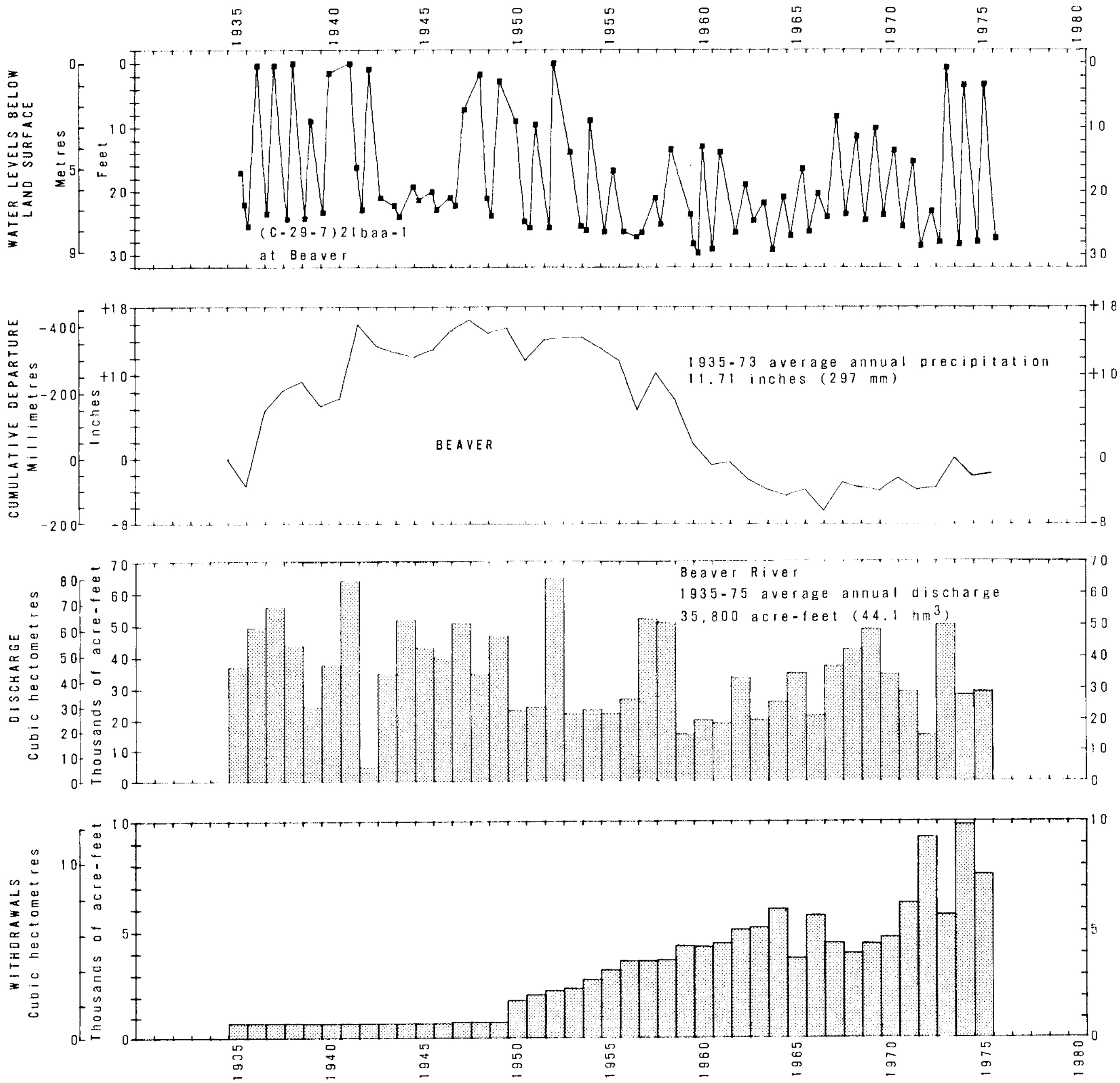


Figure 39.—Relation of water levels in well (C-29-7)21baa-1 in Beaver Valley to cumulative departure from the average annual precipitation at Beaver, to discharge of the Beaver River near Beaver, and to withdrawals from wells.

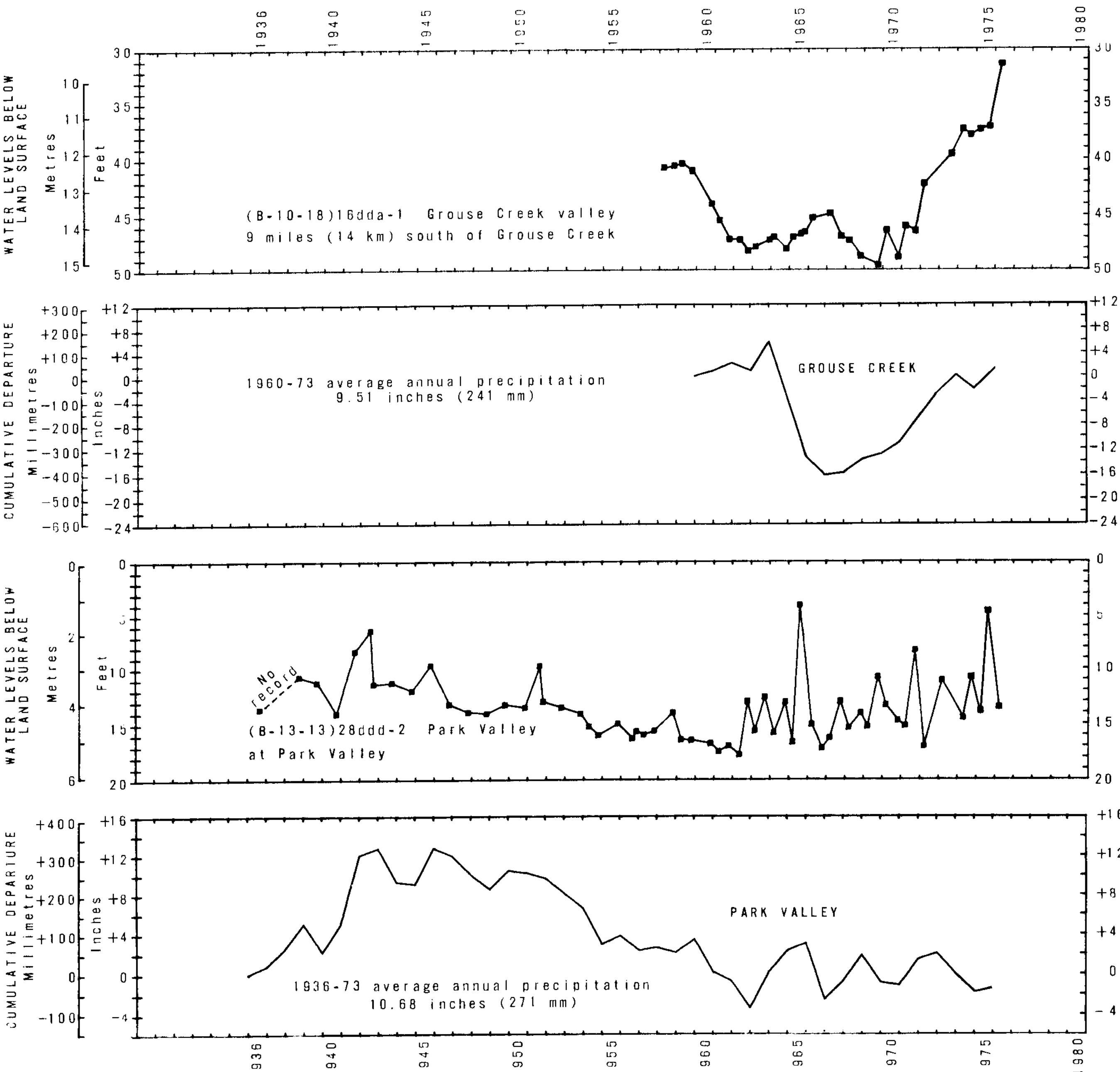


Figure 40.—Relation of water levels in wells in selected areas of Utah to cumulative departure from the average annual precipitation at sites in or near those areas.

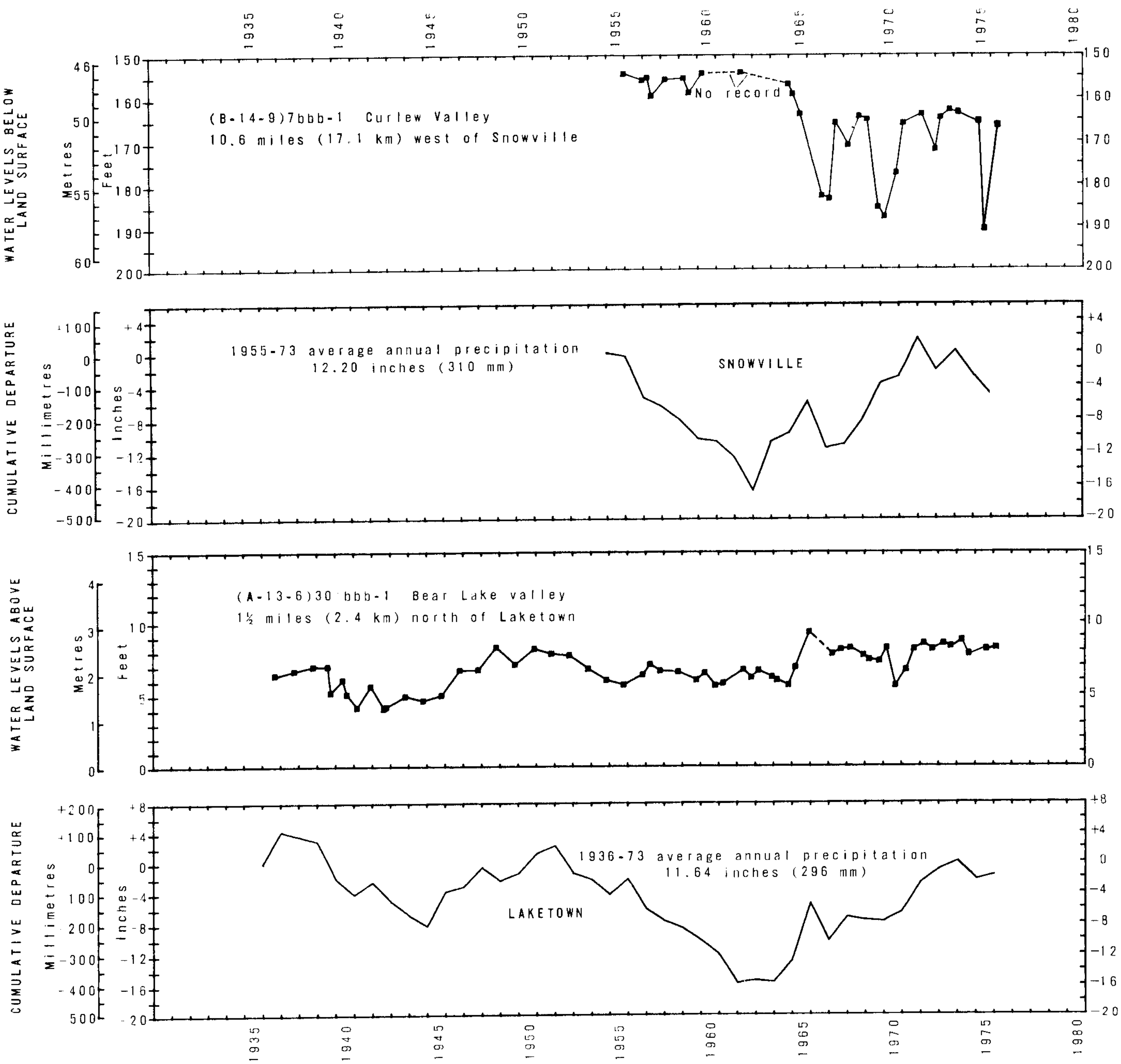


Figure 40.— Continued.

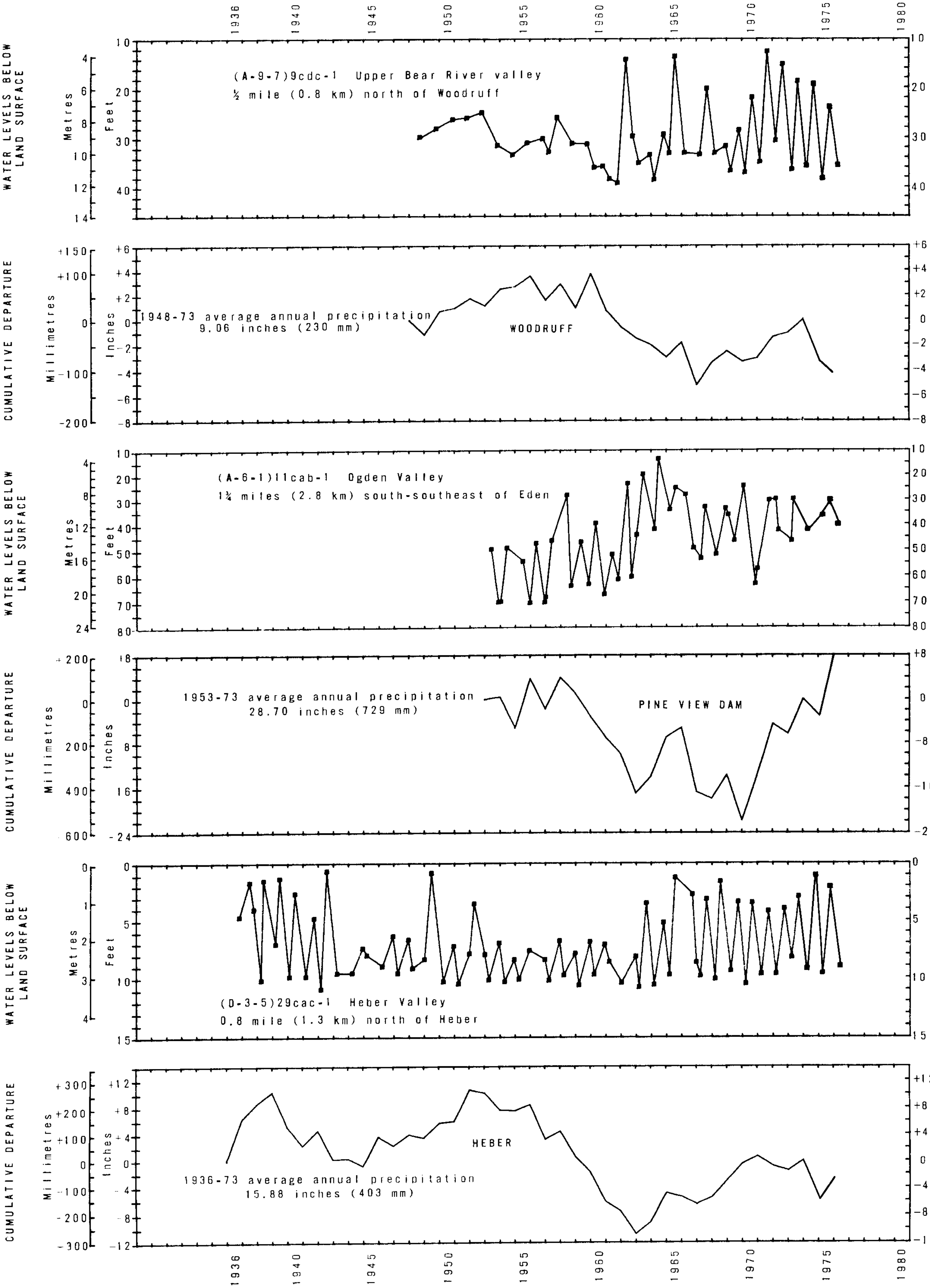


Figure 40.— Continued.

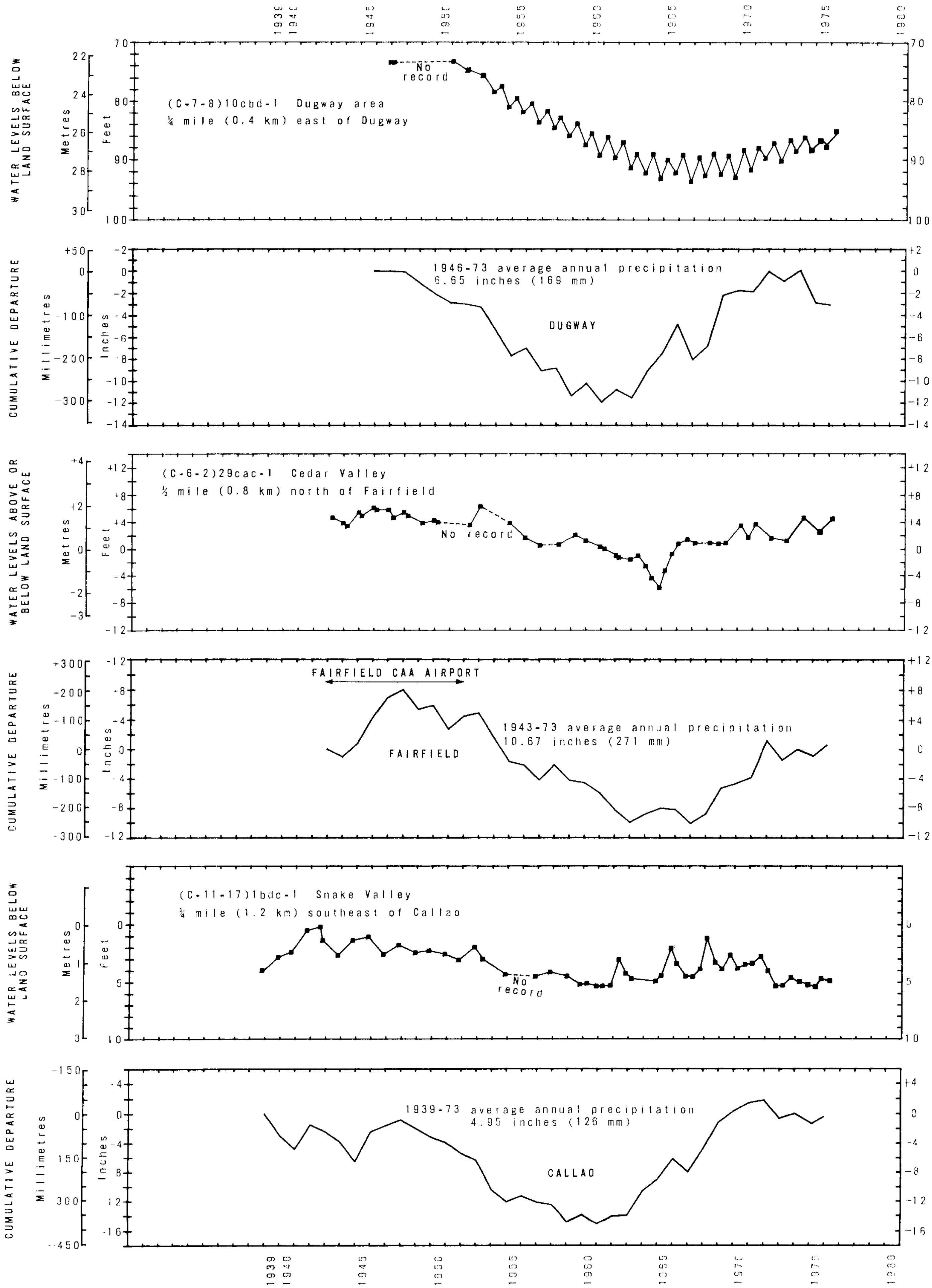


Figure 40.— Continued.

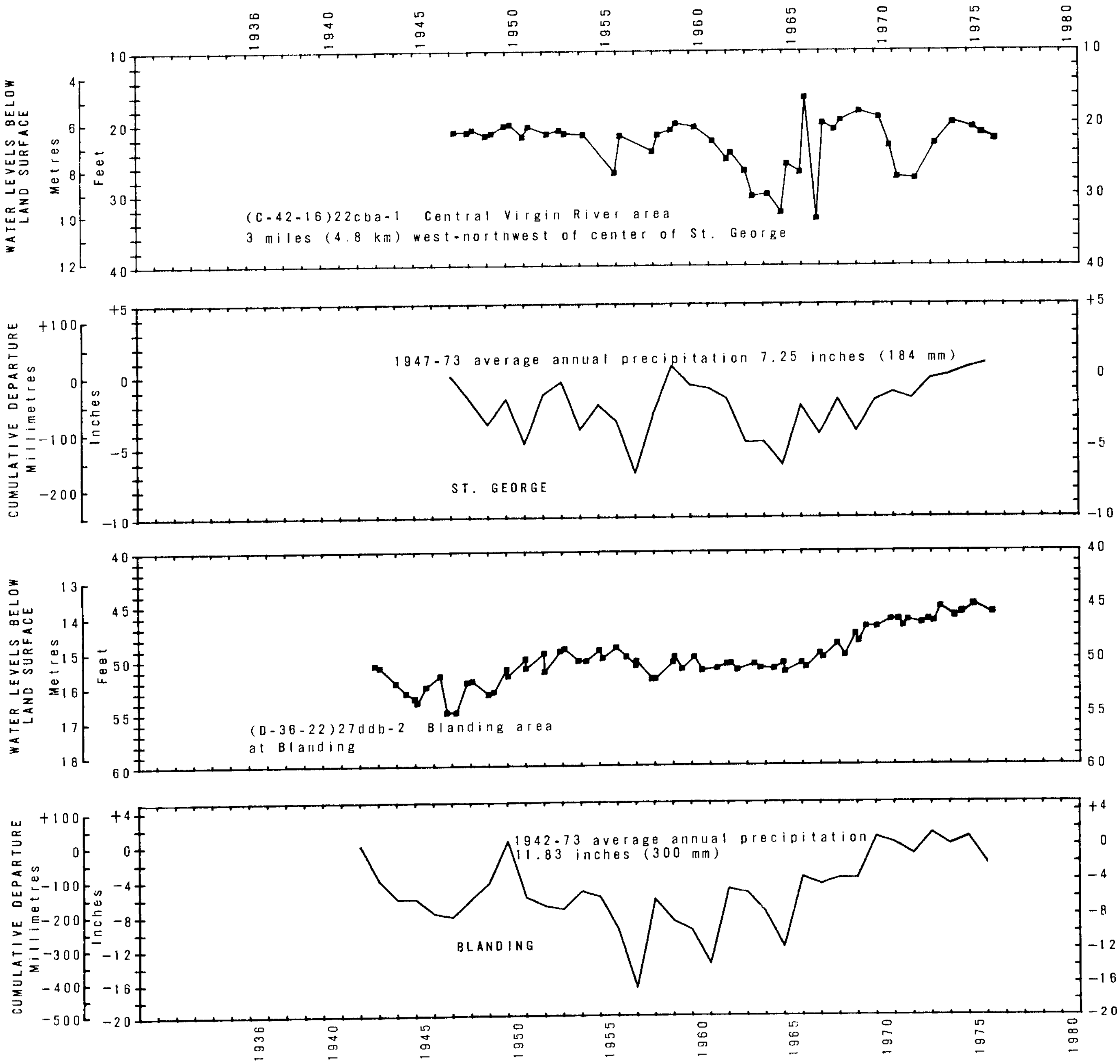


Figure 40.—Continued.

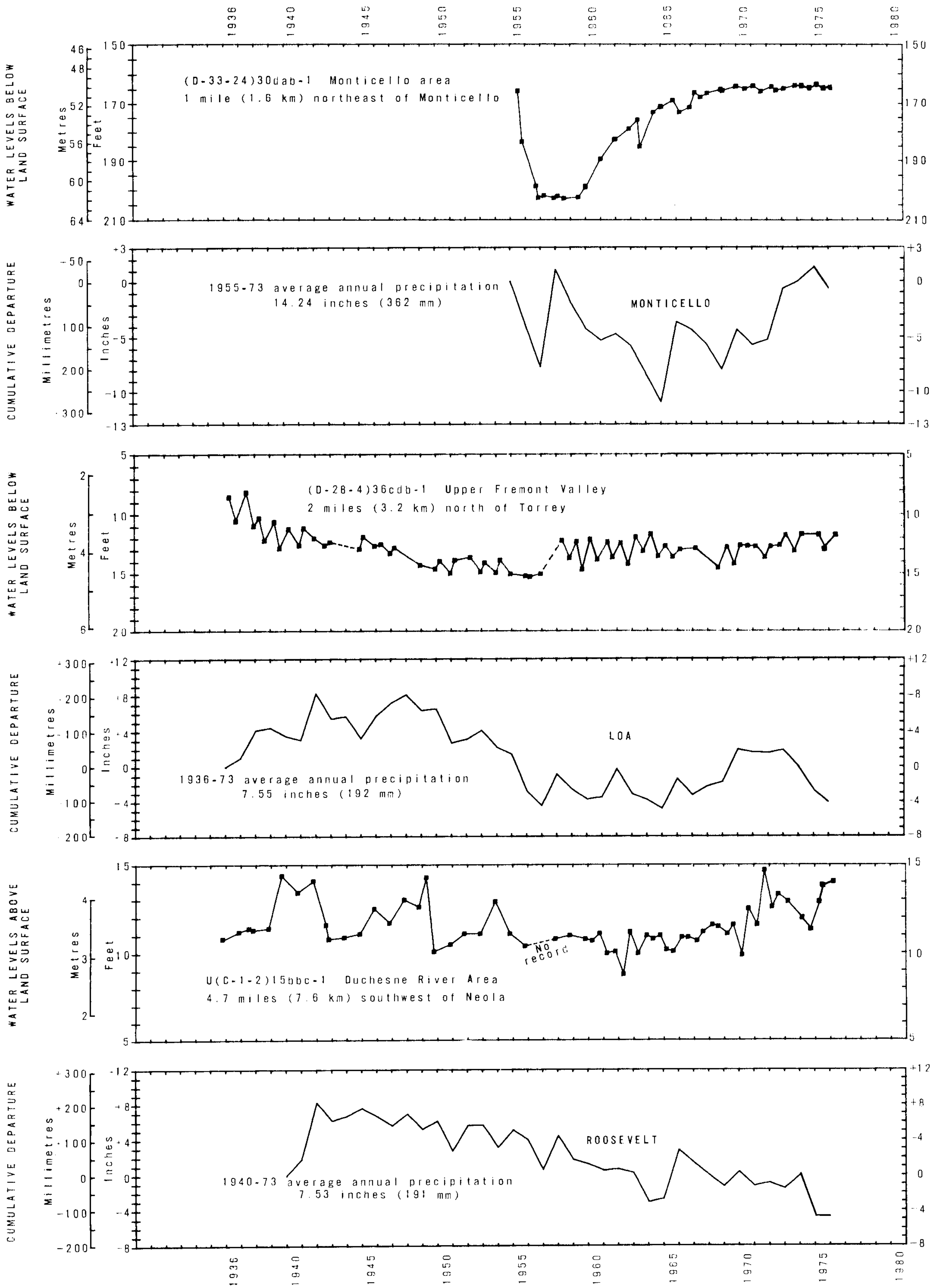


Figure 40.— Continued.

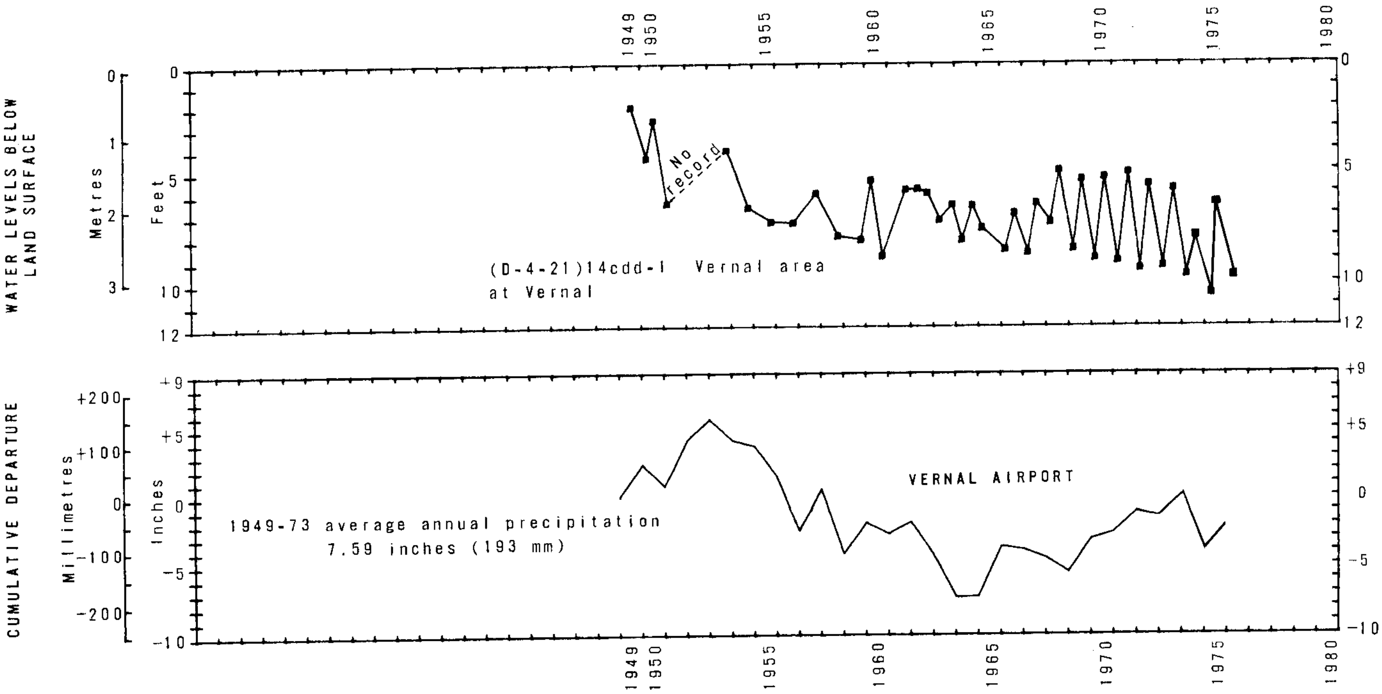


Figure 40.— Continued.